THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXI. No. 766.] LONDON, JANUARY 15, 1878. [30th Year.] Price 6d.

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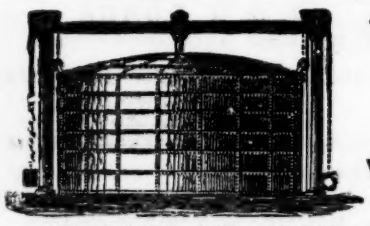

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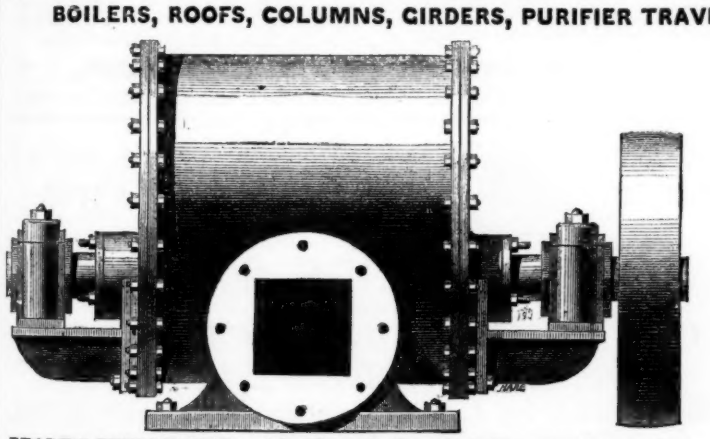

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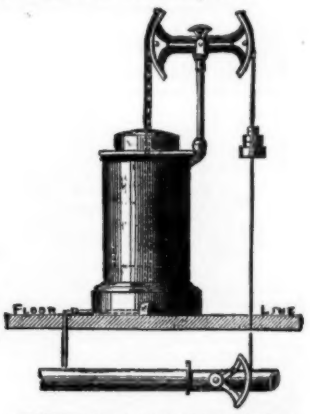
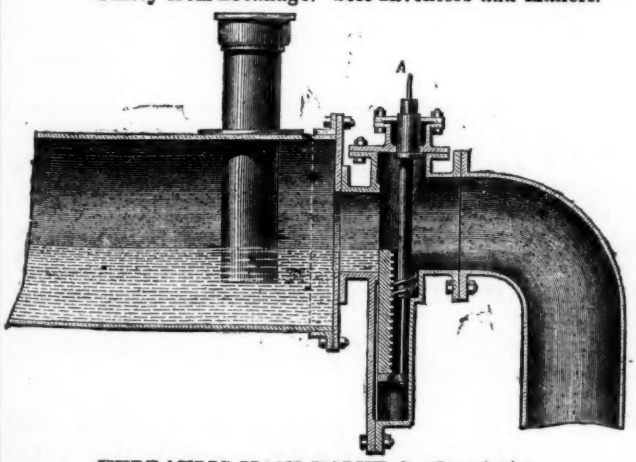


HYDRAULIC REGULATOR.



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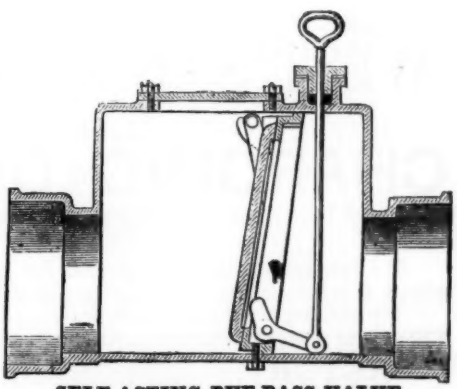

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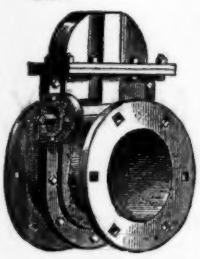

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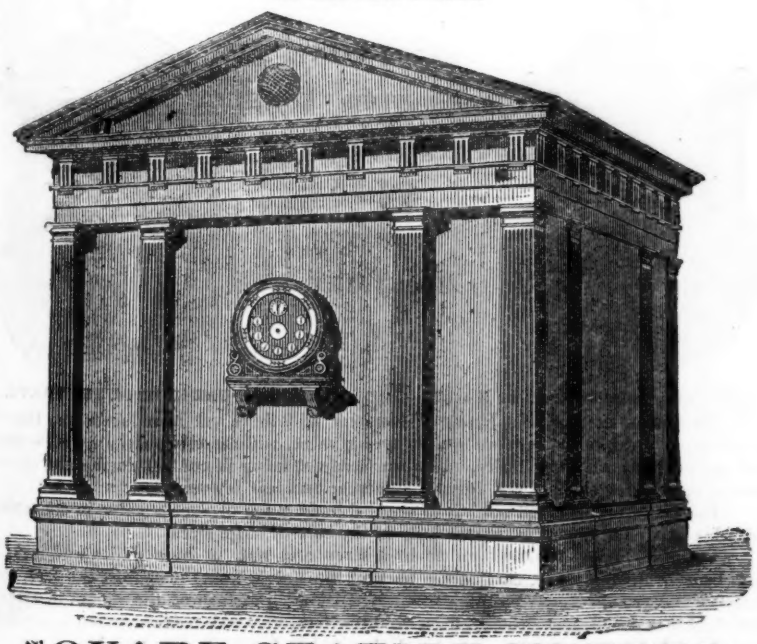

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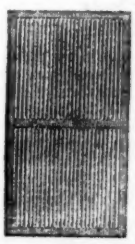

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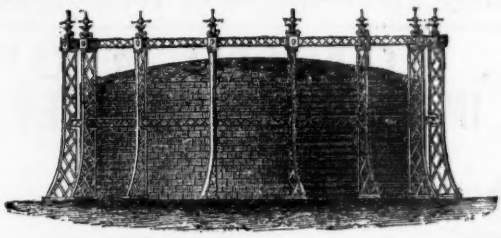
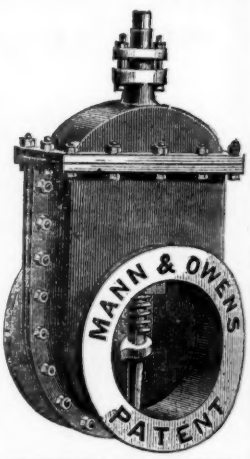
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.



THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

MANN & OWENS' PATENT GAS-VALVE.

EVERY VALVE WARRANTED TO BE PERFECTLY SOUND AND GAS-TIGHT.



VALVE, with Indicator for Above Ground. UNDERGROUND VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

SOLE MANUFACTURERS:
S. OWENS AND CO.,
HYDRAULIC AND GENERAL ENGINEERS,
WHITEFRIARS STREET, LONDON, E.C.
PRICES, SIZES, AND FULL PARTICULARS ON APPLICATION.

TANGYE BROTHERS AND HOLMAN,

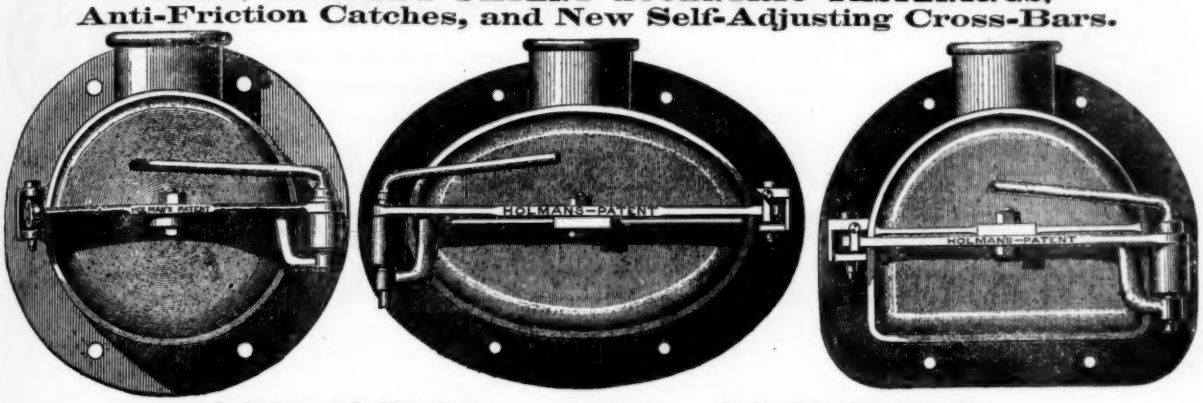
CORNWALL HOUSE, 35, VICTORIA ST., LONDON, E.C.

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

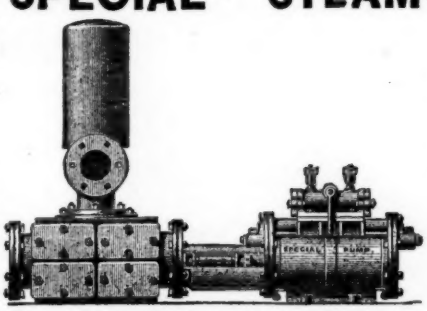
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS
HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851 New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

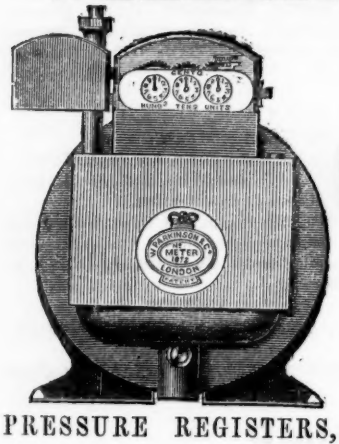
214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

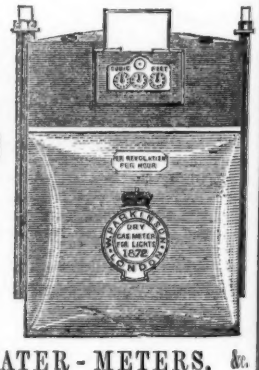
WILLIAM PARKINSON AND CO.,



(ESTABLISHED 1816,)

MANUFACTURERS OF

WET & DRY METERS,



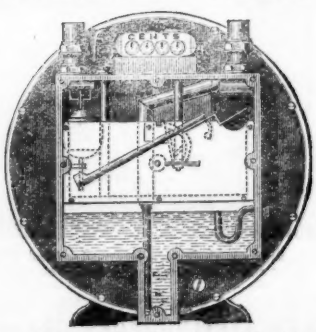
STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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Post Orders to be made payable at the Chief District Office, St. Martin's-le-Grand, London, to William B. King, 11 Bolt Court, Fleet Street, E.C.

Vol. XXX. (second half of 1877) will shortly be ready, bound in cloth, gilt letters, price 18s. Cloth cases for binding may be obtained on order from any bookseller, or from the Publisher.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

J. C., Leeds.—*Your letter reached us too late for insertion in the present number.*

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 15, 1878.

Circular to Gas Companies.

THE quarterly report of the Chief Gas Examiner again affords evidence that the Gas Companies whom he supervises faithfully fulfil their obligations to the public. Still it will be seen the Metropolitan Board of Works have had several opportunities of prosecuting, if they had chosen to avail themselves of them, unless, indeed, the Companies appealed, and obtained absolution from the Chief Gas Examiner. Nevertheless, it is clear every Gas Company under the Chief Examiner supplies gas, as a rule, considerably exceeding the standard. This fact should be borne in mind when further prosecutions are contemplated. As regards impurities, Dr. Williamson also reports very favourably. He will forgive us for putting him right upon a small point. The amounts of these impurities are not fixed by Act of Parliament, except, it may be said, in the case of sulphuretted hydrogen, the complete absence of which is prescribed by all Gas Acts. The amounts of ammonia and of sulphur in other forms than that of sulphuretted hydrogen, are fixed by the Metropolitan Gas Referees, in virtue of powers granted by the special Acts. With respect to these impurities, our readers will notice that the Companies keep well within the limits prescribed by the Referees. The "sulphur" difficulty, we might almost say, is conquered, so excellent are the results of the purification. This has doubtless been achieved at some expenditure of trouble and money; but the public will note with satisfaction that the purification has been accomplished, and, so far as we know, without any complaint of nuisance. In addition to the evidence of the Examiners appointed by the Metropolitan Board of Works, we have the independent testimony of the two Medical Officers of Health who respectively test the gas for Marylebone and St. Pancras. The reports of these two gentlemen bear witness to the good faith of the Chartered Gas Company. Dr. Stevenson's report shows that the gas supplied to the parish of St. Pancras during the last month had an average illuminating power of 16·8 candles, the minimum being more than half a candle above the standard. It must be clearly understood that this gas is supplied by the Chartered Company, and is probably a mixture of gas made at two stations.

The Chelsea Vestry are always dissatisfied. They persecute the Chartered Company for what they are pleased to call a nuisance at their Fulham works, and they would, if they dared, prosecute the London Gas Company for supplying fifteen and a half candle gas, when that Company are only required to furnish twelve-candle gas. Chelsea is blessed with a Medical Officer of Health, whom it would be difficult to satisfy in any single particular. Dr. Barclay, we imagine, is constitutionally dyspeptic, and takes gloomy views of all mundane matters. He reports to the Vestry that the gas is only kept up to the parliamentary standard by the use of a patent burner, a statement that may be accepted with some qualification. The patent burner in question simply shows the amount of light which the gas will yield. If, with a less perfect instrument, the gas gives an illuminating power of only twelve candles, it is the fault of the instrument, and not of the gas, and we repeat that the London Gas Company, by giving, on an average, fifteen and a half candle gas, deserve the gratitude, instead of the abuse, of the Chelsea Vestry. They may send their memorial, if they like, to the Metropolitan Board of Works, but we may tell them that nothing will come of it, even if the Company did not, as they do, fully satisfy all legal demands. The Metropolitan Board would be powerless in the matter. In the course of a few years the London Gas Company must go to Parliament, and will then be subjected to all the provisions imposed by modern Metropolitan Gas Legislation. But the Chelsea Vestry will not be in the least benefited. They may have gas of a slightly higher illuminating power, but the consumers will waste it in bad fittings and burners, as they do to-day. Nothing is to be gained by this continued gas agitation, even if a substantial grievance existed, but there is nothing of the sort in Chelsea. The complaints against Gas Companies originate in, and are maintained by, ignorance, jealousy, and prejudice, and we may expect that they will continue as long as Companies exist. Equal grounds of complaint would remain if the supply of gas were in the hands of some Local Authority, but nothing would then be heard of the matter, for everybody knows that complaining to a Local Authority is perfectly useless.

The newly-born Midland Gas Managers Association held their first meeting in Birmingham last week. The chair was occupied by Mr. C. Hunt, the President. A very interesting Inaugural Address was delivered, for which we are sorry we cannot find space to-day, but will publish it next week. The Association start under good auspices, and have our best wishes for their success.

The Corporation of Glossop have gone to law with the Gas Company on an interesting point. The Company have, of course, the right to take up the roadways, and they are equally of course under the obligation to reinstate them in full repair. The Corporation complain that, after opening a considerable length of roadway and pavement in 1876, the Company left it in a very unsatisfactory state. Consequently, the Borough Surveyor was instructed to put the road in order, and for the cost of doing so the Corporation now sue the Company. An order has been made in favour of the former, but it will be appealed against on purely technical grounds. The Companies Clauses Consolidation Act directs that proceedings shall be taken within six months after the commission of the offence. In this case it is not quite clear to us when the offence was committed, and it is on this point, we rather think, that the lawyers will wrangle. It is a complaint frequently brought against Gas Companies, that they leave a road, after breaking it up, in a bad state; but the charge is generally unfounded.

The Bill promoted by the Clitheroe Corporation for the purchase of the undertakings of the Gas and Water Companies has been approved by the Town Council. We understand that the terms have been arranged on a satisfactory basis, and that both undertakings will pass into the hands of the Corporation.

The Local Board of Torquay promise to persist in their unreasonable opposition to the Bill promoted by the Torquay Gas Company. The Bill is simply to gain the extended powers which are always required by the growth of an undertaking. More share and loan capital is necessary for the extension of works and distributing plant. Instead of complaining, the Local Board of Torquay should be grateful to the Gas Company for the provident foresight which seeks to prepare for the future wants of the town and neighbourhood. The new capital asked for will not be raised all at once, and we may take it for granted that none will be raised except as it is required for productive works. Then, again, the Local Board may remember the conditions under which Gas Companies may raise additional capital. We do not know whether the Torquay Gas Company will be able to show reasons why they should not be subjected to auction clauses and a sliding scale, but we may take it they will have none to offer. Consequently the new capital will be raised in a manner most beneficial to the consumers.

A town's meeting at Newbury has approved of the promotion of a Bill which, among several other things, sanctions the purchase by the Corporation of the Newbury Gaslight and Coke Company. It is a very insignificant place, and when the borough is extended, it will not become of greater importance. Supposing the Gas Company to obtain a fair price for their undertaking, they may cheerfully abandon it to a Corporation always given to grumbling, and very difficult to satisfy. The worst of it is that when a Gas Company, who have served the public fairly, part with their undertaking to a Corporation, all complaints cease, not because the grounds of complaint are removed, but because the public know full well that it is no use complaining. Take, for instance, the public lamps in Newbury. No man who knows anything of the business will for a moment suppose that they will be better supplied by the Corporation than by the Company. We well know that, with the best system of regulation, the consumption in public lights will, from unavoidable causes, differ considerably. The variation of consumption, which is spoken of in Newbury, is quite unimportant. We have found public lights, contracted for to burn five feet, actually to consume any amount, from three feet even to twelve feet per hour. Any one who chooses to go round a town and pick out all the small lights will believe that the ratepayers are being cheated; another, who observes only the larger flames, will conclude the Gas Company are too liberal. It is the case of the two knights who looked on the opposite sides of a shield. The Corporation of Newbury can have the Gas-Works if they will pay for them, but do not let any ratepayer in the Borough imagine that he will be a whit better off in consequence of the transfer.

If the Council of Newbury wish to know what lies before them in the future, they might read with profit the proceedings at a recent meeting of the Hindley Local Board, who, two or three years ago, acquired the gas undertaking. The works cannot be said to be a complete failure, but they are not specially remunerative. The pipes, it would appear, have the faculty of conveying water as well as gas, and hence the supply of the latter commodity is in some localities very short. At the present moment the question before the Local Board is the substitution of larger for smaller mains, in order to avoid the enormous leakage which existing circumstances make unavoidable. Protracted discussion in the Board ensues, and the members find it difficult to make up their minds as to what is to be done. Instead of at once accepting the advice of their Manager, members of the Board, who know nothing whatever of the matter, talk and talk, meet and adjourn, and the condition of things remains unimproved. When will Local Boards learn wisdom, and rely on sound professional advice?

Under very depressing circumstances, the Bilston Gas Company have during the past year made a very respectable profit, and are able to pay a fair dividend. In towns circumstanced like Bilston, the employment of gas is much affected by the limitation of manufacturing operations. The consumption of gas is greatly restricted, and the sale of coke becomes limited, even when offered at a very low price. These troubles are common to very many Gas Companies in the Midland district, and all we can say is that the Bilston Company, who have exerted themselves to the utmost, have so far come out of them very well. Trade, we hope, will soon revive, and then they will reap the reward of their exertions.

We have so often cautioned ignorant people against searching for a gas leak with a lighted candle or a match, that we may refer for a moment to the unhappy explosion which occurred at Southport, by which a very intelligent gentleman lost his life. He did what we have always recommended people to do, when they detect a leakage. He opened the windows of the room in which the smell of gas was discovered, and he turned off the gas at the meter; but he forgot that time was necessary for the diffusion and dilution of the escaped gas. By igniting a match immediately, he caused an explosion, which destroyed the roof of the building, and occasioned the fall of a beam, which unfortunately came down upon the Doctor, and instantaneously killed him. To the recommendations we have previously given, this unhappy incident obliges us to add one more. Besides opening all the doors and windows, and turning off the gas, it is necessary to allow a considerable time to elapse before a leak is looked for with a light. We are not perfectly informed as to the nature of the fittings in this particular case, but we are induced to believe that an ordinary water-joint pendant was in use. This apparatus is peculiarly defective. It is ill understood by consumers, who, disregarding the fact that water will evaporate, labour under the impression that it will last for ever. Cannot our scientific gas-fitters invent a joint which will protect the public from the dangers of the water-lute?

It is needless to say that we heartily sympathize with both Mr. R. H. Patterson and Mr. G. Anderson in their efforts to effect the complete purification of gas in closed vessels, by the use of ammoniacal liquor in some condition or other. It is to this we are coming, but too slowly. Still, as regards patents, we feel bound to express an opinion that there is not one at present in existence which will hold water. Mr. Patterson and Mr. Anderson have both been, to a certain extent, anticipated, and we are of opinion that only mechanical arrangements for accomplishing the desired object can form the subject matter of a valid patent. Nothing is more easy than to remove every trace of ammonia from the gas, but when we come to the removal of "sulphur," another question arises. To take out bisulphide of carbon, more lengthened contact of the gas with sulphuretted ammoniacal liquor is required; hence another difficulty arises, which we have no doubt Mr. Anderson and Mr. Patterson can easily surmount. But we have an entire objection to patents, which, for the most part, stand in the way of progress. We are very sorry when an apparent injustice is done to original inventors, but their fate is inevitable.

At a ratepayers meeting in Bangor, the promotion of a Bill to make a compulsory purchase of the Water and Gas Company's undertakings was approved, and it will probably give rise to an interesting parliamentary fight. The Company are not unwilling to sell their undertakings, but they ask £70,000, while the Local Board of Bangor offer only £42,000. Both parties are promoting Bills, and, supposing that of the Local Board to pass into an Act, unless an agreement be come to, the case must go to arbitration. We have no figures before us, but the wide discrepancy between the offer of the Local Board and the demand of the Company suggests that there are real grounds of opposition on the part of the latter. The terms of compulsory purchases are now so well understood and recognized, that we cannot imagine the Company to have made a mistake in their calculations. Local Authorities are always looking out for bargains, but their parsimony generally defeats their object.

Mr. W. Sugg has published a table, showing the number of hours between sunset and sunrise during the year, which will be useful to all Gas Companies and Local Authorities. It will save numerous references to almanacs, and may be considered to be the lamplighter's guide through the year. The publication of the table is well timed, for at the present moment there is a good deal of excitement anent public lighting. The table should be hung up in the office of every Gas Inspector, for the instruction of his subordinates as to the times they should light and extinguish.

Water and Sanitary Notes.

THE Thirlmere scheme receives a little opposition in the Manchester Town Council. It does not amount to much, however, and the opponents, not denying that an additional supply will in the course of a few years be necessary, favour the Ulleswater rather than the Thirlmere scheme; why, we cannot understand. Without professing to be acquainted with all the engineering details, we are inclined to think that the Thirlmere scheme offers the greater advantages, since the water will find its way to Manchester by gravitation alone. What the works will cost nobody seems to know, and it is variously estimated from two and a half to five millions. The very interesting account given by Mr. Alderman King, and reported in another column, as to the cost

of the existing works, shows how estimates are exceeded as works progress. If we suppose the new scheme to be carried out, it will be ten years before its entire cost is known, and if it be true that Manchester is at the present time losing £10,000 a year by supplying water, it seems tolerably clear that the ratepayers must suffer when the Thirlmere scheme is completed. A great good will, however, have been accomplished, and a somewhat heavy water-rate will be amply justified. As regards the supply of water for trading purposes, to which Mr. Alderman King seems to object, we think it is imperative on the Corporation to furnish such supply, but they should charge an adequate price. The idea of fixing Abyssinian pumps about the city would never be tolerated. It will be seen at once that the water might be used for drinking purposes, and the Medical Officer of Health would certainly report them as dangerous, and the Corporation must order them to be closed. Besides that, pure water is essential for success in most manufacturing processes. The opposition in the Council, as we have said, was very slight, and we hope in a few months to see the Thirlmere scheme carried through Parliament.

An Association of, we may take it, riparian proprietors in Scotland, have had a meeting to denounce the inefficiency of the Rivers Pollution Prevention Act. They wish everything to be done at once, but they must have a little patience. A manufacture cannot be immediately sacrificed for the sake of trout and salmon and the fly-fisher. The Act, as it is, is working fairly well; it has its defects, but as these become more and more apparent they will, no doubt, be remedied. A few years trial of its action will show what amendments are required, and the Government of the day will, no doubt, take care that it shall be amended accordingly. The Scottish gentlemen make one very sensible, although not an original suggestion—that is, that Conservancy Boards should be formed with power to put the Act in force. Local Authorities, they seem to think, are not to be trusted, being for the most part traders and manufacturers. A Conservancy Board, made up of manufacturers and country gentlemen in equal proportions, would, no doubt, deal with the matter in a more satisfactory manner. In England, especially, we want Conservancy Boards, and we hope the next session will not pass away without giving us some general provision for their formation.

The hydrants fixed in the City of London appear to be doing very effective service. One fire has been extinguished by their use alone, at another they were furnishing an adequate supply of water until a too energetic turncock opened three fire-plugs, thereby reducing the pressure on the main. The arrangements of the Corporation of London respecting these hydrants are not yet, we believe, completed. Many more are to be fixed, and hose and jets have to be provided. There cannot, however, be a doubt that our means of extinguishing fires have been greatly improved by what the Corporation have already done.

A bogus Water Bill has, we expect, disappeared. The Corporation of Exeter having agreed to purchase the undertaking of the Exeter Water Company, the promoters of the Dartmoor and Exeter Water Supply Company, Limited, have offered to sell to the Exeter Corporation an undertaking, which exists upon paper, for the sum of £2000, and the Town Council have accepted the offer. It was stated at the Council meeting, that the Dartmoor Company had been in existence six weeks; but this statement is, perhaps, not quite correct. What is true appears to be that the Town Council have voted away £2000 of the ratepayers money, and for—nothing. The Dartmoor scheme would have had no chance of success in Parliament, even if the existing water-works had remained in the hands of the old Company. Under the altered circumstances, the promoters could not have had the temerity to proceed with their scheme. It looks as though a gross job had been perpetrated, and the ratepayers had better look into the matter.

The Sevenoaks Local Board are more cautious than the Exeter Town Council. The Sevenoaks Water Company are promoting a Bill to obtain incorporation, with the usual statutory powers. There is nothing at all objectionable in the Bill; but some members of the Local Board view it with much distrust, and they have resolved to oppose it, *if necessary*. They have not yet, however, obtained the consent of the ratepayers, who, if sensible, will think twice before they allow their money to be scattered between lawyers, engineers, chemists, &c.

The experience of West Derby is not encouraging to irrigation farmers. It appears that in the course of six years in which the farm has been in operation, a loss of over £20,000 has been incurred. It is suggested this might have been saved if the farm had been properly worked. Unfortunately, most sewage farms appear to be badly worked, for they rarely produce any profit. They absorb and purify sewage, however; and that being effectually done, ratepayers may be satisfied.

PROGRESS OF CHEMISTRY.*

SECOND NOTICE.

Some of the most important work performed by Dr. Frankland relates to the examination of water, and the various papers he has written and the lectures he has delivered on this subject are contained in this volume. On succeeding Dr. Hofmann, and undertaking the examination of the metropolitan waters for the Registrar-General, he found a process of analysis in use which we rather think had been built up from the successive researches of Rose, Fresenius, and Schweitzer. It may be confessed that this process, accurate enough so far as the mineral constituents of the water are concerned, is very defective when it is desired to make an exact determination of the organic matter. It was, then, to supply an obvious defect that Dr. Frankland directed his efforts; and, after two years labour, aided by his pupil, Mr. Armstrong, he perfected what is known as the combustion process. In skilled hands, this process, with the use of well-appointed apparatus, undoubtedly yields accurate results—that is, it shows the exact amount of carbon and nitrogen in a water residue. The use of it, however, can never become general among chemists. The apparatus is somewhat expensive, its use involves a great deal of trouble, and requires much skill in manipulation. There are, we rather think, only four chemists in the United Kingdom, besides Dr. Frankland himself, who profess to employ his mode of analysis. We shall not stop to criticize the process—a work that has been done by abler hands than ours—but we may ask, When we have been told the exact amount of carbon and nitrogen present in the water, what have we been taught? Nothing, as regards the origin of the organic matter that furnished the carbon and nitrogen, which is the fact we most wish to know. When Dr. Frankland reports, as he did last week, that some of the organic matter had a very objectionable origin, he must resort to some mode of examination other than his analytical method. He has to rely on the microscope for the detection of matters which may be said to be directly offensive. In other respects it may be admitted that the process is good, always supposing it to be carried out by competent and conscientious hands.

The mode of estimating organic matter, devised by Messrs. Wanklyn, Chapman, and Smith, has, from its simplicity, acquired great popularity, and is now almost the sole method in use; but, like Dr. Frankland's, it requires for its perfect execution great care and skill. In the book we notice will be found the papers in which Dr. Frankland severely criticizes this method. We need not, however, enter upon the vexed question of the relative accuracy of the two modes of analysis to which we have referred. Each has its merits, and analytical chemists will use one or the other, according to their tastes and circumstances. Dr. Frankland utterly discards the permanganate method, in which the late Drs. Letheby and Miller had so much faith. There may be a fallacy in making a quantitative estimation of the organic matter from the quantity of oxygen consumed within a given time in its presence, but we believe it to be a very useful qualitative test.

Dr. Frankland has, as our readers may remember, written a good deal on the composition of sewage, and the modes practised and suggested for its purification. The method he most approves of is the intermittent downward filtration system; but he believes, or at all events did in 1865, that irrigation, which answers nearly as well, may be a source of profit to a town. He has, perhaps, by this time, changed his opinion on this latter point. For chemical methods of purification he has no respect at all. He regards them as simple clarifiers, which leave unaffected the organic matter in solution. Clarification is, however, something, and but for the expense of a double system, we should always recommend suspended matters to be removed before sewage is used for irrigation, and, certainly, before it is sent into a stream. There is one point with which we, with all respect for Dr. Frankland, must disagree with him. He disbelieves in the oxidation of sewage matter in running water, and tells us that "there is no river in the United Kingdom long enough to secure the oxidation and destruction of any sewage that may be discharged into it even at its source." Perhaps this statement may be true if complete oxidation is meant. But Dr. Frankland must allow that even a run of ten miles from the inlet of sewage, in some cases, makes a great change in the amount of organic matter. At one time, we imagine, Dr. Frankland must have believed in the oxidation of organic matter in running streams, for in 1868 he wrote as follows:—"If the shell of an egg were broken, and its contents beaten up with water, and thrown into the Thames at Oxford, the albumen might be converted into mineral compounds before it reached Teddington." It may be that continued experimentation has induced him to change his views on the subject; but still, for our own parts, and from our own experiments, we believe in the oxidation of sewage in running water.

Dr. Frankland is a strong advocate for the use of soft water. In one instance, and we believe in one instance only, so far as the domestic use of water is concerned, is hard water objectionable. There can be no doubt that in laundry operations there is a certain amount of waste of soap, but we believe that the amount of this waste is greatly exaggerated. In the matter of tea, we fancy that greatly mistaken notions prevail. A hard water—we mean, of course, a moderately hard water—will dissolve theine, and the flavouring matter of tea, just as well as a soft water; but people want something more than flavour; they will have colour if they can get it, and for this soft water is necessary, or the use of carbonate of soda is required. The result is the production, especially after long standing under that ugly abomination, the cosey, of that nasty vapid infusion which passes

* "Experimental Researches in Pure, Applied, and Physical Chemistry." By E. Frankland, Ph.D. (Marburg), D.C.L., F.R.S., &c. London: Van Voorst, 1877.

in society as tea. Vegetables are quite as well boiled in hard water as in soft, and we are told, on very good authority, that potatoes are the better for being boiled in hard water. We rather think that Dr. Frankland is somewhat mistaken as to the sanitary effects of soft water. *Cæteris paribus*, we believe that towns supplied with hard water are more healthy than those supplied with soft; but the facts that govern the rate of mortality have been so imperfectly studied, that it is hazardous for us to express any opinion on the matter. Most certainly, we think, it may be said that the soft water towns of the North have the highest rates of mortality; but then it is to be remembered that they have also the densest populations.

We have filled all the space we can devote to this notice, and must now conclude. We have not referred to the first section, which gives an account of researches which earned for the Author an European reputation. Released from the labours incident to the Rivers Pollution Commission, let us hope that Dr. Frankland will return to the object of his first love—pure chemistry. If he will cease from his persistent attempts to scare the public and damage the Water Companies, and betake himself to such studies as occupied him in 1848–49–50, he will acquire a wider and more enduring fame than can ever be obtained by water and sewage quackery, on which the whole Metropolis looks with contempt.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CLV.

DISTRICT GOVERNORS (*continued*).

Mr. W. White's automatic valve-governor is exhibited in the annexed woodcuts, figs. 9 and 10, which are a vertical section and an elevation with lid removed to show the interior of valve-chamber. In a cast-iron box or chamber is contained a flap-valve, hung by a strap, and hinged at two places to ensure the metallic valve, which is faced, always coming into close contact with the seat. This latter is at a slight inclination from the vertical, so that the tendency of

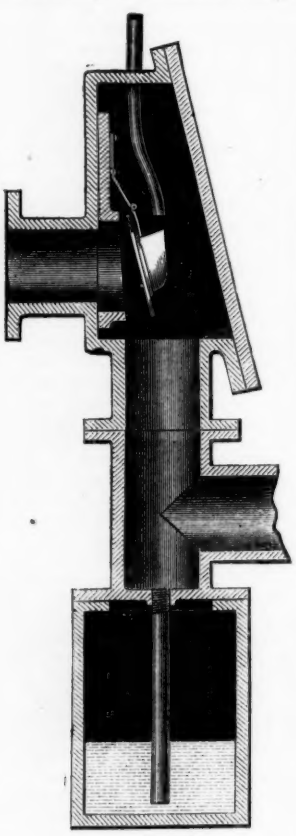


FIG. 9.

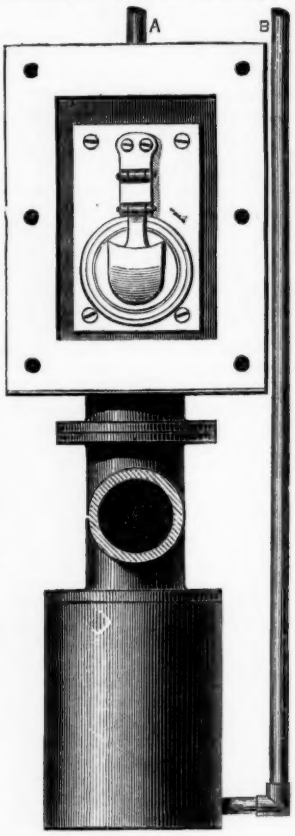


FIG. 10.

the valve is to close. For the purpose of weighting the valve to the pressure desired, a pipe, A, is brought to the surface, through which lead shot is dropped into the pocket fixed to the back of the flap. A syphon-box is attached to the bottom of the governor to receive the fluids condensed in the main, the vertical pipe, B, shown in fig. 10, being for the purpose of applying a pump at the surface for emptying the same.

A compact and useful district governor has been invented by Mr. W. Foulis, and is illustrated in fig. 11. This apparatus, which is made by Messrs. W. and B. Cowan, is altogether novel in design; and, being most sensitive in its action, and occupying the minimum of space for a wet governor, it is peculiarly valuable for the purpose intended. The drawing represents one for an 18-inch pipe, and is to a scale of three-fourths of an inch to the foot. The outer case, A A, is of cast iron, closed both at top and bottom, and having a valve-seat, D D, cast within it. B is the inlet, and C the outlet pipe. The valve, E, is formed of two inverted cones, having a cylindrical prolongation, with the necessary float, the object of making the cone double being to neutralize the effect of the inlet pressure; or, in other words, to prevent the inlet pressure from exerting any influence on the action of the governor. In order further to attain this object,

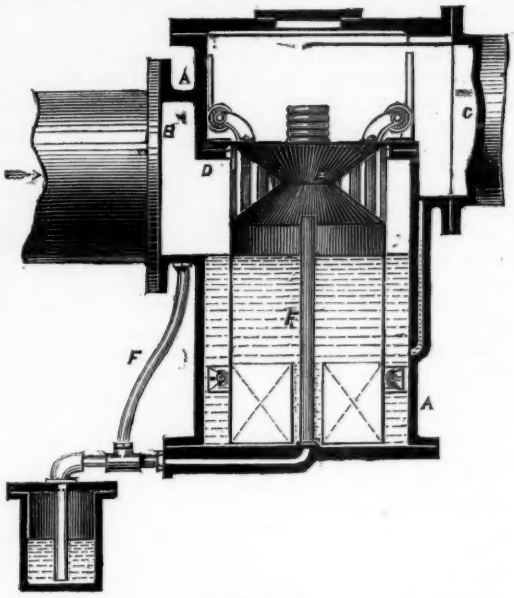


FIG. 11.

the triangular space formed by the two cones is enclosed by a continuation of the cylindrical portion of the valve. In this, slits are cut of sufficient area, and so adjusted that when the valve is open to the full, the area of the portion of the slits below the valve-seat is rather greater than that above it, thus establishing a uniform pressure in the triangular space, and so equalizing the pressure on the two conical surfaces.

A small pipe, F, is led in at the bottom of the outer case into the interior of the valve. The valve is guided by three pulleys fixed on its top, and the same number of pulleys attached to the outer case at some distance from the bottom. By this arrangement the valve may be withdrawn on removal of the top cover. The vessel is charged with glycerine to prevent freezing. The apparatus is used as a station governor, but it is with its arrangement as a district governor that we are now dealing. When the pipe, F, is connected with the inlet-pipe, and the float loaded to the required amount, the governor is differential in its action—that is to say, the difference between the inlet and outlet pressures is constant, thus enabling the pressure on the district governor to be reduced to any required extent below that at the works.

The differential governor of Mr. H. E. Jones is exhibited in the accompanying drawing, fig. 12. It consists of a cast-iron box, divided into two chambers, upper and lower, by a central diaphragm division-plate, on which is supported a vertical pipe; the diaphragm has slotted holes on its side near the top, which latter may be surmounted either by a flat plate or by an upright cone. If the former

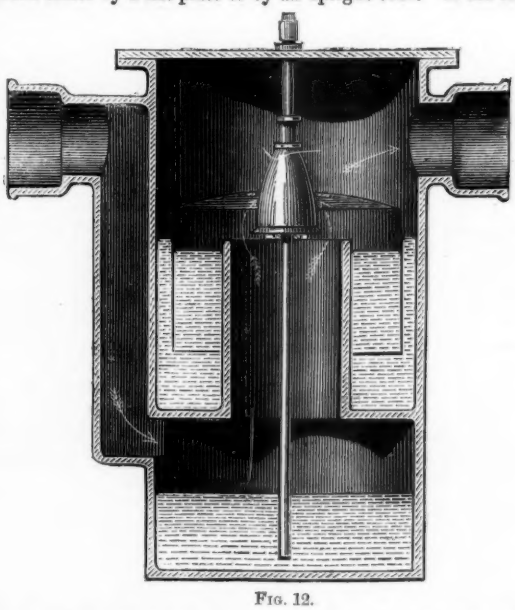


FIG. 12.

be used, a conical collar or ring is attached to the under side of the crown of the holder, and seats itself on the plate; but if a cone be employed, the ring is less in depth, and is made, as usual, to fit the

cone base. When the governor is fixed in the line of main, it has no communication with the atmosphere, for the small vertical pipe is intended only for the attachment of a syphon-pump, and is capped in the ordinary way.

The action of the apparatus is as follows:—The gasholder being weighted so as to require, say, 6-10ths of an inch pressure to raise it, the gas, on entering the bell, has first to overcome its resistance, and if the incoming pressure is less than 6-10ths, it is evident that the holder will not be raised from its seating, and therefore no gas can pass. If, however, the pressure exceeds the 6-10ths, the gasholder is lifted, but only such quantity of gas passes as is due to the pressure in excess of 6-10ths, for that pressure must of necessity be maintained underneath the bell in order to support it. Thus suppose the pressure on the inlet to be 10-10ths, then that on the outlet will be 4-10ths; on increasing the pressure on the inlet to 20-10ths, the outlet pressure becomes 14-10ths, and so on. Consequently the governor responds to changes in the initial pressure at the works during the hours of day and night.

The system of periodical district pressure taking, advocated by Mr. Warner, is eminently worthy of attention.* It is only by having an intelligent knowledge of the varying pressures throughout a district that will enable a Manager to give an efficient and economical supply of gas. The pressure, as Mr. Warner aptly observes, is the pulse of the system, and an intimate acquaintance with this at all points, and during the different hours of consumption, is absolutely required to ensure satisfactory distribution.

(*To be continued.*)

LIGHTING BY ELECTRICITY.

(*Continued from page 49.*)

The next invention which comes under our notice is a communication from "a foreigner residing abroad," and patented by Mr. E. A. King, in 1845. It will be seen that this inventor anticipated by many years the improvements that would be necessary in the apparatus for lighting by electricity before any general use could be made of it. The ideas of the patentee are clearly set forth in his specification, and, since his time, others have followed in the same track with a view to improvements, but no practical results have followed. Notwithstanding the lapse of years, and the efforts made during the interval, one great difficulty—viz., the divisibility of the electric current emanating from the same source, is still in the distance; and, as regards its distribution, for the purpose of lighting in competition with gas, is as far off as in the days of King's correspondent. This invention, to which we now refer, was not intended to supersede the regulator, such as now forms a part of the electric lamp, there being none of any merit then in use, but was clearly intended to get rid of the difficulty that brought the regulator into existence—that is the keeping the carbons at such a distance as to fully develop the voltaic arc, according to the power of the current generated, for he says:—

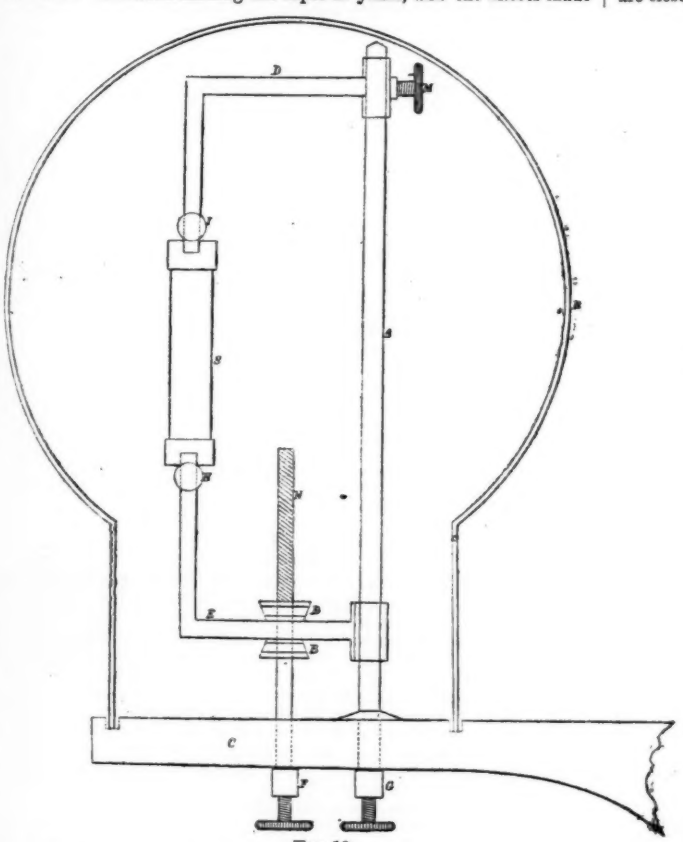


FIG. 10.

"The nature of this invention consists in the application of *continuous* metallic and carbon conductors, intensely heated by the passage of a current of electricity, to the purpose of illumination. The metal found to be the most advantageous to use for the purpose is that which, while it requires a very high temperature for its fusion, has but a feeble affinity for oxygen, and offers a great resistance to the passage of an electrical current. Platinum, though not so infusible as iridium, has but little affinity for oxygen, and offers a great resistance to the passage of the current; and as it is abundant, and easily worked into the requisite form, it appears to be preferable to any other metal. The platinum should be worked into those exceedingly thin sheets known as leaf platinum. This may be accomplished by the ordinary process of the goldbeater; but a more accurate method is to place a piece of platinum foil between two thick plates of rolled copper, and reduce the whole to a thin sheet by rolling, when, on separating the copper pieces, the platinum leaf will be found of uniform thickness in every part. In this way it may be obtained so thin that on holding it before a printed page the letters can be distinguished through it. A strip is to be cut from one of these sheets, of a width proportionate to the quantity of the current, which with Grove's cells, having the platinum plates 3 inches long and 2 inches wide, is about one-fourth of an inch, and of a length proportionate to the intensity, which, of course, varies with the number of cells.

"Great care must be taken to cut the platinum strips of an equal width throughout, and with a clean edge, as, if this is not carefully attended to, the strip will be unequally heated, and will be fused in one part before the other parts have obtained a sufficiently high temperature to produce a brilliant light. The platinum strip is now to be suspended between two forceps in an instrument made for the purpose, one form of which is shown in section in the drawing annexed, marked Fig. 10. A is a square brass bar, fixed into the wooden stand, C, having a binding screw, F, attached to its lower end. The two arms, E, D, are attached to sockets, which slide on this bar, so as to admit of their being placed at different distances from each other. They are both bent at right angles, as seen in the figure, and terminated by broad forceps tipped with platinum. These forceps are closed by the milled screws, H, I. The arm, E, has a rod, N, with a screw cut on it passing through it, and by means of the two nuts, B, B, working on this rod, the arm may be adjusted to any required height, and the distance between the forceps thus regulated. The rod passes through the stand and is attached to the binding screw, G. The socket is lined with ivory or some other non-conducting substance, so as to prevent any metallic communication between the arm, E, and the bar. S is the strip of platinum leaf, which is first clamped in the upper forceps. The arm, E, is now adjusted to any required height, and the lower forceps are closed, so as to clamp the lower end of the strip of platinum. It may now be included in the battery circuit by attaching one of the wires to the binding screw at F, and the other to that at G. The current should be one of considerable intensity, and the distance between the forceps should be sufficient to prevent the platinum being fused. The distance may be lessened by raising the arm, E, and shortening the strip of platinum until it attains the highest temperature it will bear without fusing, or the same object may be attained by increasing the intensity of the current. The glass shade, R, which serves to screen the platinum from currents of air, dust, &c., may then be placed over the apparatus, as seen in the drawing.

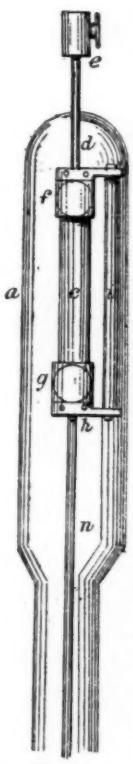


FIG. 11.

"When carbon is used, it becomes necessary, on account of the affinity this substance has for oxygen at high temperature, to exclude from it air and moisture. To accomplish this in the most perfect manner it should be enclosed in a Tooricelieu vacuum. One form of the apparatus for this purpose is shown in section in the drawing annexed, and marked fig. 11; *a* is a glass tube similar to those used for barometers, except that it has its upper end enlarged into a cylindrical bulb and a stout platinum wire sealed in at the top. A binding screw is fixed on the top of the wire, whose lower end screws in the iron piece, *d*. To this piece the forceps, *f*, are attached, and it is connected with a similar piece at *h* by the porcelain rod, *i*. The forceps, *g*, are attached to *h*, and clamp the lower end of the carbon piece, *c*, which has its upper end held by those at *f*; *n* is a copper wire, which is fixed into the piece at *h*, and extends to the bottom of the tube; the tube is filled with mercury in the same manner as a barometer, the usual precautions being taken to expel the air; its length, independent of the bulb, should be about 30 inches, so that when it is inserted in a cup of mercury a vacuum will be formed in the bulb. The instrument is included in the electrical circuit by connecting one of the wires from the magnetic or voltaic battery with the binding screw fixed on the wire, *e*, and the other with a wire which passes into the mercury in the cup at the bottom of the tube. The circuit is thus completed by the column of mercury, and, when it is depressed in the tube by the formation of vapour of mercury, the connection is preserved by the copper wire, *n*. That form of carbon found on the interior of coal gas-retorts which have long been used is well suited for this purpose, and may be worked into the form of either small pencils or thin plates by the aid of the saw and file. As carbon will bear a very high temperature without fusion or volatilization, it may be employed when a very intense light is required. When an intermitting light, for the use of lighthouses or for other purposes, is required, it may be obtained by breaking the circuit at intervals by clock-work. To effect this, one of the wires from the magnetic or voltaic battery is connected with a spring, which is made to press on the circumference of a metallic wheel fixed on one of the arbors of the clock, having certain portions of its surface cut away, so as to break and close the circuit at any required intervals. When the apparatus is suitably sealed it may be applied to submarine lighting, and also to the illumination of places where it is necessary to guard against the inflammation of highly combustible or explosive compounds, as in powder magazines, mines, &c."

The last paragraph of this specification refers to an arrangemen'

* The system described by Mr. Warner has been so recently given in these columns (proceedings of British Association of Gas Managers, JOURNAL OF GAS LIGHTING, Vol. XXX., p. 96) that we need not further allude to it here. In the "Treatise," when published as a separate work, full details of the plan will be given.

for producing more than one light or luminous point, by means of a single current, from one source—at once the great desideratum and the great difficulty. Were it not for the flippant manner in which statements concerning this matter are made, and assurances are given of its near accomplishment, we should pass it by without remark, knowing that all those who have paid any attention to the progress of electric lighting are well aware that it is as far from being realized, by simple means, now as when the paragraph was penned. The inventor says:—

"When a current is of sufficient intensity, two or more lights may be made in the same circuit, care being taken to regulate the power by increasing or diminishing the number of armatures, if a magneto-electric machine is the source of electricity, or the number of cells if a voltaic battery be used, so that the united resistance of the strips of platinum or carbon shall be sufficient to prevent the passage of such a quantity of electricity as would destroy them."

The document from which the above quotation is derived is, as we have before seen, dated 1845. The following may be considered to date from December, 1877:—The Lyons Railway Station is now lighted by electric lamps, and the system adopted is one devised by M. Lontain. He proceeds by sending a current, generated by a powerful dynamo-electric machine, to an electro-magnetic arrangement so contrived as to distribute electricity to the different points of light; not *divide* the current first generated into as many streams as there are lamps, but rather by the velocity of its own revolving parts, and the influence received from the first engine, to bring into action as many electro-magnets, and, thereby, the induction of as many currents as are represented by one-third of the number of lights required, it being asserted that each induced current is capable of actuating three such lamps as those in use at that place—twenty-eight being the number now supplied. The first attempt at division was simple, but defective; and so have been all the attempts of those who have laboured to develop the same idea. The second system, however applicable it might be to the purpose for which it is applied, cannot be pronounced a *simple* method, even if we admit it to be a division at all, in the sense in which it was first understood. Patents are accumulating for inventions for the production of electricity, and decided improvements are apparent. The lamps also—that is, their regulators—are attaining a state of accuracy that renders it easy to procure a powerful light; but the means for the application of electricity to general lighting are, for anything we now know of, as far off as ever.

(To be continued.)

Birmingham Gas Arbitration.—The *Birmingham Daily Post* says this arbitration was resumed on the 27th ult., before Sir Henry Hunt, umpire, and Mr. Hawksley and Mr. Bramwell, arbitrators respectively for the Corporation and the Local Boards. The Court adjourned on the 29th, and sat again from the 1st to the 5th instant. The whole time was occupied in hearing the case for the Corporation, who submitted a statement showing the profits accruing from the portion of the undertaking comprised in the West Bromwich district, on which their witnesses—Mr. Spice, C.E.; Mr. Price Williams, C.E.; Dr. Pole, C.E.; Mr. Law, C.E.; Mr. Charles Hawksley, C.E.; and Mr. George Livesey, C.E.—based their valuation. Mr. Chamberlain, M.P., and the Town Clerk were present during the whole time on behalf of the Corporation, and the former gave evidence on the 5th instant. His cross-examination was not concluded when the Court rose, and an adjournment has been arranged till the 1st of February, when the Court will sit to the 8th of February inclusive. Mr. Michael and Mr. Will appeared as counsel for the Corporation, while Mr. Rodwell, Q.C., Mr. Matthews, Q.C. (who took the place of Mr. Thesiger, recently appointed one of the Lords Justices of Appeal), Mr. Webster, Mr. Pembroke Stephens, Mr. Young, and Mr. Underhill appeared for the various Local Boards.

Price of Gas in Lancashire and Yorkshire.—At a meeting of the Ratepayers of Little Lever, near Bolton, on the 27th ult., Mr. Thomas Bramwell, a member of the Local Board, read the following extracts from a return which he had received relative to the prices paid for gas in certain towns in Lancashire and Yorkshire:—

Town.	Population.	Price per 1000 Feet.
Radcliffe	11,446	5s. 3d.
Fleetwood	6,500	5s.
Hyde	16,000	4s. 6d.
Littleborough	8,500	3s. 9d. to 5s.
Over Darwen	26,000	4s. to 4s. 3d.
Padiham	9,000	3s. 8d. to 4s. 9d.
Dukinfield	18,000	3s. 2d. to 4s. 2d.
Denton	6,000	3s. 2d. to 4s. 2d.
Todmorden	22,000	4s. 8d.
Altrincham	10,000	4s. 6d., less discount.
Birkdale	6,500	4s.
Ince-in-Makerfield	14,000	3s. 10d.
Ormskirk	6,127	5s. 6d.
Milnrow	6,700	3s. 9d.
Whitworth	10,700	4s. 3d.
Worsley	7,000	14s. 6d. per 1000 hours.
Bacup	28,000	4s. 8d., less discount.
Openshaw	13,500	3s. 10d. to 4s.
Moss Side	12,000	4s. 2d.
Rusholme	9,000	4s. 4d.
Sale	6,600	4s.
Swinton and Pendlebury	20,000	4s. 8d.
Stalybridge	2,300	3s. 11d. to 4s. 6d.
Great Harwood	5,500	4s. 6d.
Barton, Eccles, Winton, & Monton	20,000	4s. 8d.
Prescot	5,990	5s. 3d.
Heaton Norris	5,000	4s. to 4s. 8d.
Levenshulme	2,500	4s. 2d.
Heywood	23,000	4s. 2d.
Leigh	20,000	5s. 6d., less discount.
Atherton	10,000	4s. 3d. to 4s. 7d.
Chorley	16,864	3s. 6d., 3s. 9d., and 4s.
Bowdon	2,200	4s. 6d., less discount.
Garston	8,000	4s.
Haydock	5,286	4s. to 4s. 6d.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

A SIMPLE METHOD OF CHARGING RETORTS.

Sir,—The drawing and charging of retorts by machinery is a subject that has taken the attention of many gas managers during the last ten or twelve years, and no doubt the machinery that has been brought into use has proved a success in many large gas-works. But, unfortunately, it is of no use for small works, such as I and hundreds of other managers have the control of. Now, Sir, I contend that if the saving of labour and gas is worth considering in a large work, it is proportionately so in a small one; and I am sure if some of our great gas engineers would bring out some simple machine for works making from 3 to 30 millions per annum, they would be well repaid for the trouble.

I have been recommended by many to adopt the hand scoop, but the difficulty has been the necessity of employing three men on a shift to work it, and again I object to the picking up of the charge so many times. In the first place, it is picked up in the coal stores, then thrown down upon the retort-house floor, picked up again to load the scoop, and then lifted into the retorts.

I enclose pencil sketch of a simple arrangement that I have adopted during the last four months for charging, which can be worked either by one, two, or three men. And if you would kindly publish it in your Journal no doubt it would prove a great benefit to many gas companies and stokers.

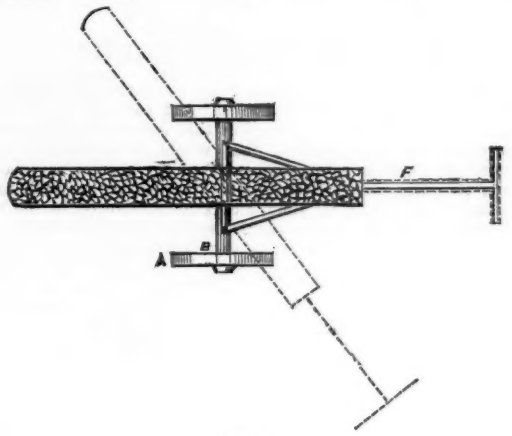


Fig. 1.

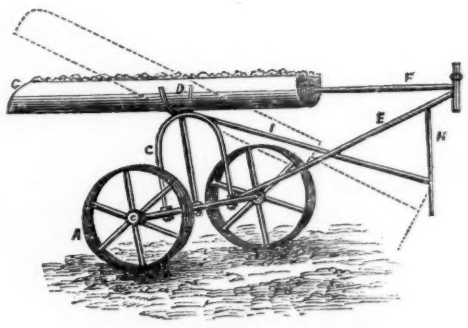


Fig. 2.

Figs. 1 and 2 are a plan and elevation of hand scoop and truck. A A are two cast-iron wheels, 2 feet diameter; B, 2½-inch by ¾-inch axle; C, ¾-inch round iron bow stay; D, half-round swivel stay secured with pin through the bow stay and axle; E, truck handle; F, scoop handle; G is the scoop; H, truck leg; I is an iron stay which supports the bow stay, truck handle, and leg. It will be noticed that the two handles are of the same size, and one upon the other, and secured with slip ring or hook, when being loaded or pushed about. The dotted lines show that the scoop can be lifted up or down, and to the right or left angles. When the retorts are ready for charging, the machine is run parallel with the bed, the wheels being 1 foot 6 inches on the off side of the retort, the scoop is then turned upon the swivel stay, and lifted or lowered until it is lodged upon the mouthpiece, and then lifted from the truck and pushed into the retort. It is then turned over, drawn out, and lowered upon the truck, which stands in the right position for receiving it. I need not refer to the many advantages there are in connection with this simple arrangement, as it will be readily seen by any gas manager. My stokers are very pleased with it, and would be sorry to take to the old system of charging by the hand shovel.

Gas-Works, Hinckley, Jan. 4, 1878. John Surl.

P.S.—I keep two scoops and trucks of different heights, one for the top, the other for the bottom retorts, and the one is being loaded with coals while the other is being unloaded.

PURIFICATION OF GAS.

Sir,—Your editorial remarks on the case of *Patterson v. The Gaslight and Coke Company* open up a view that is quite new to me. It appears that Mr. Patterson has another patent, of date 1873, for the purification of gas by prepared ammoniacal liquor.

In 1874 or 1875 I wrote several letters, which you were kind enough

to insert in the JOURNAL, proposing the same thing. Had I known that the idea had been already patented, I should have said so; and although I have been forestalled, I am pleased to think I am not alone in the views I held, and still hold, and now more firmly than then; because I have now ample proof, from the workings of my combined washer and scrubber, that the whole of the ammonia can be removed from the gas. This has been proved by several of those machines erected at different works, with the one uniform result of a total removal of the ammonia.

At one of our London works I have seen a stream of gas issuing from the outlet of one of these machines, bubbling through a reddened solution of litmus, that remained without discoloration for several days; a slip of turmeric paper also remaining in the stream of gas unchanged.

I have held for some years that the imperfect results obtained from washers and scrubbers were due to defective construction—namely, in not ensuring a finely-divided state of the gas, and an intimate contact with the purifying material; hence my design of passing the gas through the fibres of a revolving and constantly-wetted brush. From this step, now accomplished, I have no doubt that, by properly prepared liquor, as indicated in my former letters, we can, by a series of those machines, remove every impurity; because ammonia can be made to remove all the other impurities which the gas contains.

I am, moreover, of opinion that this is the good to which we are tending—namely, the purification of gas *in closed vessels* by operating on the ammonia which the gas itself will furnish, and that the operation will be perfectly innoxious, will cost but a mere trifle for labour, will be conducted in one-fourth of the space hitherto required for scrubbers and purifiers, and at less than one-half the previous cost for apparatus, while the operation may be carried on anywhere without nuisance, even in the heart of a town.

But if we are to be met by the impediment of another patent, query, will the progress of improvement not be retarded? Few companies will be willing to risk the litigation and worry, expense, and questionable honour that have been attached to the above-mentioned case. Some company may, indeed, now be experimenting in that direction, and on the result of the Lords decision may be advised to resist.

This, to my mind, would be most undesirable; and I would suggest for the consideration of any who may wish to improve their process, whether it would not be well to, at once and for all, purchase up any remaining patent rights Mr. Patterson may possess, so that their chemists and engineers may be free to act with their full force, without the apprehension of further litigation.

The companies are now victorious. Like generous victors let them now hold out the olive-branch. Let Mr. Patterson meet them in a liberal spirit, and we may arrive at an amicable peace that will harmonise all parties, sink the past in oblivion, and begin a new race that I am certain will end in every way beneficial to the gas companies.

GEORGE ANDERSON.

35A, *Great George Street, S.W., Jan.* 11, 1878.

CORRECTIONS.

SIR,—With all deference to Dr. Phelps, he is wrong in his letter of last week. The discharge of gas is as the square root of the pressure, and not, as he states, in the *inverse* proportion of the square root of the pressure.

I cannot agree that there is any inaccuracy in the expression: "The pressure of gas in the mains varies," &c. There is an actual pressure in the mains due to the weight of the gasholders.

Jan. 9, 1878. WRITER OF THE "TREATISE" ARTICLE.

DUBLIN GAS AND IMPROVEMENT BILLS.

SIR,—I observe poor Mr. Cleminshaw has made another application to the Dublin Corporation for payment of his account. As you may have something to say on the subject in your next, I send a cutting from a Dublin paper, anent another "Bill" about which similar difficulties have arisen.

In a light-hearted spirit our Corporation promote Bills. Not waiting for a settlement with their creditors on the Gas Bill, they took up a grand Improvement Scheme, which broke down at the Standing Orders stage, with a liability of £1506 incurred.

The first named on the "official list" has issued a summons and plaint, which will probably run through all the courses of the Cleminshaw suit; but by that time the Corporation will have been deeply engaged on another Bill.

The respectable citizens of Dublin view with disgust those proceedings of their so-called "representatives."

Dublin, Jan. 6, 1878. J. M'EVOY.

OUR LAST "IMPROVEMENT" BILL.

TO THE EDITOR OF THE "IRISH BUILDER."

Sir,—What have you done to the Corporation that your name does not appear in the list of creditors now claiming payment of their "little bills" for work and labour in promoting by "Bill" the improvement of the city? The following is the official list:—

William Smith, London—taking references	£165	0	0
Forster and Co.—lithographing	39	15	0
Hodges, Foster, and Figgis—do.	9	10	0
Tudor and Smith—scrivenery	6	11	7½
Parke Neville—expenses	4	13	0
R. W. Walsh—preparing plans	26	5	0
Dollard and Co.—printing	210	13	2
Freeman's Journal—advertisements	123	3	0
Daily Express "	148	15	0
Mail "	155	13	6
Nation "	16	16	0
Irish Times "	135	12	0
Saunders "	140	0	0
Farmers' Gazette "	13	10	0
Muggeridge and Badham	310	16	8
	£1506	13	11½

Given, a Bill thrown out on Standing Orders to cost £1506, how much for one passed into an Act? Considerate, was it not? to give our *Farmers* notice through their own *Gazette*, and our Irish *Nation* through its own organ; but why pass over the *Irish Builder*, and our martyred colleague, the *Irishman?*

AITKEN AND YOUNG'S PROCESS.

SIR,—"If any Gas Company can, by the employment of Aitken and Young's process, supply a richer gas at a lower price than can be furnished by the ordinary rough-and-ready process, we shall be very glad to see it."

These words occur in the "Circular to Gas Companies," in your issue of the 25th ult., and they seem to me to be framed in a manner that will enable all to echo the words, "So shall we." But I fear that the hypothetical two first words of your sentence are serious stumbling-blocks, and the removal of these, that the word "A" might be substituted as a beginning, is delayed indefinitely.

When I made a suggestion, relative to this subject, in your issue of the 10th of July last, it did not occur to me that Messrs. Aitken and Young might soon give an opportunity for the remarks I have just made; but I will show shortly my reasons for coming to the conclusion I have done.

Gas manufacturers have, within the past few years, had two schemes submitted to them for the more economical manufacture of gas—viz., Mr. Malam's process, and that of Messrs. Aitken and Young. The mode of procedure, the volume of gas per ton realized, and the description of the secondary products obtained, are totally different, in these processes, the one from the other. In Mr. Malam's process there was a large volume of gas obtained per ton of coal, and the destructive distillation was carried on so perfectly that, besides the gas, the only residue that may be said to have remained from the "black diamonds," was a quantity of dry "lampblack," choking up mains, condensers, connections, and even passing into the station-meter. That Mr. Malam came to patent his process was probably owing to his works having become dilapidated, and possibly not working very satisfactorily. He built a new bench of retorts, and finding that by his high heats he obtained a large production of gas per ton of coal, and being annoyed with choked ascension-pipes, he devised and patented his "jacket," surrounding the mouthpiece and ascension-pipes, and containing water to keep the pipes cool and prevent chokes. But not being content with this, he added the incandescent coke at the back end of the retort, through which the gas, generated within the retort, had to pass before reaching the outlet. This led to further decomposition, so that, although there was an extra large yield, the whole volume of gas given off was bound to be less luminous, so that the advantages he had gained before applying this new form were destroyed.

In Messrs. Aitken and Young's process, however, high heats are not desired, and, while using an inferior coal, they do not obtain a large yield of gas, but by a second process try and pick up the naphthas from the tar, so as to improve the illuminating power of the gas produced by the first process. Still they seem not to be quite happy over the results of their efforts; and, at the best, the process appears to me to be very like a milkmaid going on separate occasions to skim the cream from off her milk, so as to get better results, instead of waiting until a proper time, and getting it all by one effort.

We have a few hints of what Messrs. Aitken and Young wish to accomplish by their process, in the report of the proceedings of the West of Scotland Association of Gas Managers, published in your issue of the 13th of November last, p. 762; and as their desire is a very laudable one—viz., to take out as large a proportion of the naphthas as possible from the tar—I will quote a sentence or two from the speakers at that meeting, and compare them with a statement of what has fallen within my own experience bearing on the subject.

1. Mr. Aitken remarks that, "No doubt the tars got by the new way of working do not contain the naphthas; but, on the other hand, they can be sold as once-run tar, and the market price of this article is, I believe, higher at present than crude tars, and there is a large market for them."

2. Dr. Wallace says: "In regard to this process, if the object of the gas manager was to make tar rich in naphtha, this process would be the worst; but, if he wants to make gas, and considers tar a secondary product—as it has always been considered—then I think this process is an immense step in advance of anything we have had before." And again: "In the tar made at Hamilton, though the proportion of naphtha is less than in tar made in ordinary circumstances, yet there is something like half the quantity left. I shall not be content until I see a larger proportion of the naphtha taken out than has been the case hitherto."

3. Mr. Young, about the latter part of his remarks, says: "I believe that, with the most perfect instrument, so long as we use rich coals there will be left a surplus of the denser naphthas, because the rich gases are not able to take up those naphthas and hold them in suspension." He further observes: "There is no doubt that this process effects a considerable saving." And yet again: "It only requires a little time, perhaps, to develop the mechanical arrangements by which the most perfect results may be obtained."

On referring to the copy of a letter which is in my possession, and dated December, 1872, I find that from the mixture of coals I was then using, and charging each retort with 1¾ cwt., I obtained 13,800 cubic feet per ton, and by putting 2 cwt. into each retort I obtained 13,500 feet per ton. Another letter, dated Jan. 2, 1873, shows me that the average production per ton for the month of December, 1872, was 13,327 cubic feet of gas, the quality was never under 28 candles, and the gas was permanent. So far as I can remember, my average production per ton for the winter six months was 13,300 cubic feet, and during the summer six months 11,600 cubic feet. I had been able to reduce the unaccounted-for gas in these works by about 2½ per cent. each year, and during the year quoted the leakage was also reduced 2½ per cent. over the previous year.

The coals used were from five different pits—four of them of a good quality, and one a splint coal; the process was the ordinary, by no means in perfect order. The tar from the hydraulic main I could never run into a tar-well, though only seven yards distant from the hydraulic main; but by erecting a cistern close up to the hydraulic, and allowing the tar to drop into it, and by keeping a small coke fire burning day and night under the cistern, the tar was made to flow through a stopcock on the side of the cistern into a barrel, which as often as it was filled was removed. Very frequently this was done without any bung being put into bung-hole, as the contents got so stiff as not to

require one, and the finger could be pushed amongst the pitch in the bung-hole, and be taken out quite clean. The tar from the condensers was thick, and the ammoniacal liquor flowed with the tar quite clean and separately, without having any inclination to mix, and without any oily appearance.

Now I assume from this that, by a well-regulated ordinary process, the quantity and quality of the gas to be taken from a mixture of coals can be so regulated by the proportions of the mixture and the heats of the retorts as to leave little, if any, naphtha in the tar; and that without any fuss, such as the working of another separate process on the works, whereby a large outlay of capital would be required, and with working expenses in fuel and labour for steam, and keeping a separate watchfulness over temperatures, which seem quite uncalled for. Besides, gas carburetted in the manner proposed would not be so permanent if required to stand some days in the holders, or to travel considerable distances through mains and services, as it is when distilled by a proper heat, once and for all, in the retort.

And now as regards the quotations from the report of the proceedings at the West of Scotland Association of Gas Managers meeting.

1. To Mr. Aitken's remark I can say that the tars in an ordinary process can be made to contain little or no naphthas, and that the advantage of the product being thus equal to once-run tar, and obtaining a higher price in the market than crude tars, will stand equally good on behalf of an ordinary process.

2. Dr. Wallace's remarks lead me to think that the new process has not yet been able to do anything equal to the ordinary process in reducing the quantity of the naphthas in the tar; therefore the new process is a very good and altogether very feasible way of enriching the tar—by low heats in the first process, and imperfect distillation in the second. The tar will remain a secondary product, unless we take after Mr. Malam's idea, and erect lampblack chambers in place of tar-wells. The tar at Hamilton having still one-half of the naphtha in it, the statement I give shows better working, and when the finger can be inserted into the bung-hole and come out clean, I have no doubt but that Messrs. Aitken and Young will be content with the proportion of naphthas taken out of the tar.

3. As to the remark of Mr. Young on the impossibility of taking out the denser naphthas, even with the most perfect instrument, my statement will show it can be, and has been, done. The considerable saving he speaks of should be defined, and the "perhaps," in the last sentence quoted, is, I think, the only word that makes the clause correct. "Bosh" is not exactly the word I would like to use for the remainder, only I should like to know where there is a gas manager, with time and the means, that will not make his gas-works very near to achieving "the most perfect results."

I should like to see the statement describing the value of saving, after one year's working of the Aitken and Young process, as compared with the ordinary process, and, of course, I would require to see the gas-works that the process improved upon.

Now, Sir, I conclude that Mr. Malam's gas-works were ripe for the improvements he made upon them, and that the Company are reaping the benefit; also I conclude that the Hamilton Gas-Works were ripe for improvements, by additional condensers, &c., and I have no doubt that the Corporation are receiving the benefit. And as between the Malam or Aitken and Young process, I fancy the ordinary, which you term the "rough-and-ready" process, will yet have a considerable time to wait for the "development of the mechanical arrangements" referred to, and the accompanying "most perfect results."

WILLIAM KEY.

Tradeston Gas-Works, Glasgow, Jan. 4, 1878.

SHARE CERTIFICATES.—A correspondent, "J. N.," says: "We have several shareholders who have lost their share certificates, and require new ones to be issued in place of the lost scrip. The Directors will require an indemnification before issuing them. Does the said indemnification require to bear a stamp for the nominal value of such shares, or will it do without any stamp at all, on being signed by the Shareholder, and duly witnessed?" By the Companies Clauses Act, 1845, sec. 11, it is provided that any holder of shares in a company can demand a certificate of proprietorship, under the corporate seal, on payment of a sum not exceeding half-a-crown; and by sec. 13 it is enacted that "if such certificate be lost or destroyed, then, upon proof thereof to the satisfaction of the Directors, a similar certificate shall be given to the party entitled to the certificate so lost or destroyed," a similar fee being payable. The Directors are not entitled to ask for any indemnity, nor do they require any, nor does the substituted scrip require any stamp other than that of the seal of the Company.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1878.

The following memorials, complaining of non-compliance with the Standing Orders, were deposited in the Private Bill Office on or before the 9th inst.:—

Cheltenham Water Bill, from Stephen George Millen.

Nottingham Improvement (Gas and Water) Bill, from Charles Rogers and others.

Cheltenham Corporation Water Bill, from George John Kirby and Charles C. Burke.

Metropolis Water Supply Bill, from (1) East London Water-Works and Grand Junction Water-Works Companies; (2) Kent Water-Works and other Companies; (3) West Middlesex Water-Works and New River Water-Works Companies.

GAS EXPLOSION AT SWINTON.—Early on Saturday morning, Jan. 5, a serious explosion of gas occurred on the premises of William Brown, boot and shoe maker, Moorside, Swinton. A large quantity of gas appears to have gathered between the ceiling and bed-room floor, and in order to discover where the leakage was, Mr. Brown incautiously applied a light to the ceiling above the parlour chandelier. The gas instantly exploded, throwing Mr. Brown some distance, and, setting fire to his hair and clothes, burnt him very seriously in the face, neck, and hands. The building was cracked from the scullery to the roof. The glass in most of the windows was forced out, and the furniture and stock in the shop sent flying in all directions. So great was the force of the explosion, that it was distinctly heard at the distance of a mile. Fortunately, no one was fatally injured.

Legal Intelligence.

GLOSSOP PETTY SESSIONS.—MONDAY, DEC. 31, 1877.

(*Before Messrs.* SHEPLEY *and* BUCKLEY.)

ACTION TO RECOVER COSTS OF REPAIRING ROADS AFTER MAIN-LAYING.

The Glossop Gas Company were sued by the Glossop Corporation to recover the sum of £47 13s. 6d. for the repair of a road at Hadfield, which the Company had opened for the laying of mains, and which it was alleged they had left in an incomplete and imperfect state, and the Corporation had to make it good.

Mr. ELLISON, town clerk, appeared for the Corporation, and Mr. BARKER, barrister, Sheffield, appeared for the defendants. Mr. HIBBERT, of Hyde, acted as the legal adviser to the Magistrates.

Mr. ELLISON, in opening the case, said he had to apply for a certain sum of money from the Glossop Gas Company, for doing some repairs to a road in Hadfield which the Company had neglected to do. Some few years ago the Corporation adopted the Local Government Act, and since then they had become surveyors of the highways. The Gas Company had authority to take up the streets, but before doing so they should give the Corporation notice. They, however, did not do so in this instance. For the purpose of lighting Hadfield they had a lot of road broken up, and according to their Act they should have made the road good, but they did not do so, and the summons was to recover the amount expended in doing what the Company had neglected to do. The work was not completed before the 6th of July last, and the Corporation were therefore clearly within the six months specified in the Act.

Mr. BARKER said that, in order to save the time of the Court, he would state his objections to the case proceeding. In the first place, the Corporation had no right to demand any sum; it was for the magistrates to assess it. Then the Company altogether denied the delay, and if that could be proved, the Magistrates had no jurisdiction in the matter. The 153rd section of the Companies Clauses Consolidation Act, 1845, enacted that "No person shall be liable to the payment of any penalty or forfeiture imposed by virtue of this or the special Act, or any Act incorporated therewith, for any offence made cognizable before a Justice unless the complaint respecting such offences shall have been made before such Justice within six months next after the commission of such offence." If the Magistrates, therefore, made an order in this case, the Company would appeal to a superior Court.

Mr. HIBBERT said he thought the case had better proceed, for if there was no order made there would be nothing to appeal against.

Mr. *Ramsbottom* having proved serving the notice on the Gas Company, signed by the Town Clerk,

Mr. *James Nuttall*, Surveyor of Highways, was called and examined by Mr. ELLISON. He said: I have had control of the streets under the Urban Sanitary Authority for eight years, acting for the Corporation. In the month of September, 1876, the defendants broke up Hadfield Road for the purpose of laying down larger gas-mains, and the work continued into November. There was a continuous line of 272 yards on the pavement, and 870 on the macadam; and the depth of the trenches on the footpath was between 3 and 4 feet, and on the macadam 18 or 20 inches. The width varied on the pavement 3 to 4 feet, and 2 feet on the macadam. I had no intimation from the Company that they were going to do the work; they did it in their own way, and I did not interfere. Before they commenced the work the pavement was in good condition, and the top and bottom part of the macadam also; but there was a short distance between, not so good. After the mains were laid, the subsoil and the macadam were put in together instead of separate, and the work was consequently left in an imperfect state. People spoke to me frequently about it, and in February I began to do something. There had been a delay from November to the 9th of February, when we began to take off the ridge; we repaired it and made it good, and completed it about the 6th of July, 1877. We did not work continuously, as we had to wait for its settling, which accounted for the delay. We repaired 860 yards of macadamized road, and 272 yards of pavement. The pavement was done by piece-work, and the macadam by day-work. The number of days engaged on it was 143½, at 3s. per day, amounting to £21 10s. 6d., which was paid by the Corporation. That amount was for the macadam road. Then I had a horse and cart 10 days, at 7s. 6d. per day; broken stone, 50 loads, at 3s. 4d. a load, £8 6s. 8d. making the total of the items mentioned, £33 12s. 2d. For the pavement we have charged 8d. per yard, £5 13s. 4d.; horse and cart, 2¼ days, 17s.; 12 loads of gravel riddled, £1 10s.; two men 3½ days riddling, £1 1s.; total for pavement, £9 1s. 4d. I have charged £3 for superintending the work. My wages are 30s. a week. I made a demand in July for £65, but I did not make a demand before the 14th of July for any money for the job. When the defendants left the road there was a ridge five or six inches in a very rough state.

Cross-examined by Mr. BARKER: We first of all charged 4d. per yard more, which was to allow for subsidence. Whatever care we take we cannot avoid a subsidence. I was constantly about the roads, and saw them doing the work, but I did not offer any objection. As the work proceeded I saw it was being done badly, and still I did not object to it. I cannot say when I first complained to the Company; when the foreman was working on the job I complained to him. On the 21st of June I wrote of a letter to the Manager, but it was for Norfolk Street, and not for Hadfield. It had been customary for us to repair the roads after the Company, and charge them for so doing. I have no feeling against any member of the Gas Company. I have charged £3 for my services. I may have neglected some part of the Corporation work. I saw at the time that the work was not properly done. I clearly saw they had not restored the roads last November.

Re-examined by Mr. ELLISON: I did not know what rights we had. I never said anything to the Company about the mode of doing the work.

Benjamin Walsh said he remembered the road being taken up, and he saw it after it had been filled in, and it was left in a very unfit state, and was an annoyance to the public. It was imperfectly filled in, and stood of a ridge, and there were a lot of loose stones about,

Mr. SHEPLEY said the case had better be adjourned, as he was obliged to leave.

Mr. BARKER said it would be very expensive if he had to come again, and suggested that an order be made for £40, with leave to appeal given to the Court of Queen's Bench to quash the proceedings, as the action had not been brought within the six months prescribed by the Act.

After some further conversation it was agreed that an order should be made for £42 13s. 6d., and the Company to have leave to appeal.

On a subsequent day the Company served the notices of appeal upon the Magistrates giving the bond required in such cases.

DARWEN PETTY SESSIONS.—THURSDAY, JAN. 3.

(*Before Messrs.* ECCLES *and* GRAHAM.)

CONVICTION FOR BREACH OF THE WATER-WORKS CLAUSES ACT, 1863.

Mr. *Christopher Leach*, plumber, &c., was summoned by the Local Board of Darwen for a breach of the Water-Works Clauses Act, 1863.

Mr. RADCLIFFE appeared to prosecute; Mr. BACKHOUSE appeared for the defendant.

The case first came before the Bench on Dec. 13, when Mr. Radcliffe stated that the proceedings were taken under the 19th section of the Act, which was as follows:—"It shall not be lawful for the owner or occupier of any premises supplied with water by the undertakers, or any consumer of the water of the undertakers, or any other person, to affix, or cause or permit to be affixed, any pipe or apparatus to a pipe belonging to the undertakers, or to a communication or service-pipe belonging to or used by such owner, occupier, consumer, or other person, or to make any alteration in any such communication or service-pipe, or in any apparatus connected therewith without the consent in every such case of the undertakers, and if any person acts in any respect in contravention of the provisions of the present section, he shall for every such offence be liable to a penalty not exceeding £5, without prejudice to the right of the undertakers to recover damages from him in respect of any injury done to their property, and without prejudice to their right to recover from him the value of any water wasted, misused, or unduly consumed." The water-works at Darwen were the property of the Local Board, and it would be proved that Mr. Leach was executing the plumbers work of four houses in Primrose Hill, and also the plumbers work of three houses at Ashleigh. In August he gave notice to the Local Board that he wanted the water turned off, in order that he might connect the pipes to the main. The Water Bailiff went to the place for the purpose of turning off the water, but on finding that the pipes intended to be laid were only 6 lbs. to the yard, instead of 7 lbs., he refused to do so. In the middle of September it was discovered that Mr. Leach had caused the pipe to be fixed to the main, and that all the four houses were being supplied with water, the same course having been adopted at the houses at Ashleigh.

Mr. *T. Duxbury*, the Manager of the Water-Works; Mr. *Marsden*, the Water Bailiff; and Mr. *Taylor*, a Clerk in the Water-Works office, having having given evidence in support of the opening statement, the case was adjourned.

At the sitting of the Court this day the same witnesses were recalled and further examined.

Mr. Backhouse said his defence was a distinct denial of the statements of the complainants. He should show that his client connected the piping with the consent of the Board, that the water was turned off by the servants of the Board, and that it was turned off after notice had been given to the Board, and when his client had a perfect right to connect the pipes.

John Harwood, who in August last was a labourer in the employ of the Local Board, said he knew the property in Primrose Hill. He remembered the pipes being connected. He was sent to the place by a person in the office, to turn off the water. That person had sent him to turn off water often before. Witness turned off the water by instructions from Mr. Taylor.

W. Baron deposed that he went with Harwood to turn off the water. He had turned off water scores of times.

Mr. *James Leach*, defendant's nephew, said he was the person who gave notice that Mr. Leach wanted the water turned off. He saw Baron and Harwood in the yard. They went to the place and turned the water off in his presence. He never saw Marsden about the matter. Marsden never told him that he would not turn off the water.

This closed the first case, and the Bench decided to reserve their decision until they had heard the next case.

Mr. Radcliffe said the second charge was for connecting the pipes of three houses at Ashleigh, belonging to Messrs. Cocker and Knowles. It was stated for the prosecution that no notice was given to the Board about coupling the pipes, and in September they were found to have been connected.

Mr. Backhouse said that Messrs. Cocker and Knowles, as the owners, should have been summoned. Harwood, who was a servant of the Board, to whom notice was given, authorized Leach to turn on the water, as he could not go to the place at the time he was wanted. This he had done often. He told Marsden that he had instructed Leach to couple the pipes.

The Bench inflicted a fine of 40s. and costs in each case.

Mr. Backhouse applied for a case, and it was granted.

GREENWICH POLICE COURT.—Tuesday, Jan. 8.

(*Before Mr.* Balguy.)

CONVICTION OF STOKERS FOR NEGLECTING WORK.

John Thompson, stoker, *George Steele*, scoop driver, and *John Butler*, stoker, appeared to summonses under the Employers and Workmen Act, charging them with absenting themselves from work without leave or notice, and for which a claim was made upon each for £1 compensation. The defendants had been in the employ of the Phœnix Gas Company at the works at Greenwich, and they formed three of a gang whose duty was to work during the night of Sunday, the 23rd ult. The three defendants, who lived in one house at Deptford, failed to attend at six o'clock in the evening, and other men had to be sought for to take their places. This caused a delay of an hour, the retorts being left empty, more fuel being burnt, and the neighbouring consumers being liable to have been put to inconvenience.

Mr. *Rolten*, foreman of works, proved that printed notices were posted at all parts of the works that a week's notice was required on both sides as to discharging or leaving, and Mr. *Wates*, the Engineer at the works, said he had most moderately estimated that the loss sustained by defendants absence was £3. The defendants, he said, were good workmen, earning 38s. per week, but since November last had twice similarly misconducted themselves, of which no notice had been taken. The Company regretted having to take the present proceedings, and although the summonses must be pressed, he would promise, if they made amends, to take them back again. That morning there were seventeen men absent, a state of things which frequently happened after receiving pay or at holiday time.

Thompson and *Steele* pleaded guilty, complaining that there was no holiday allowed, and they had to take one; and *Butler* excused himself by saying he was unwell, suffering from pain in the back, but he offered no such excuse some days afterwards, when he went to the works and was discharged.

Mr. Balguy said there were hundreds and thousands of men in the mining districts who would be glad to have the employment and wages the defendants had deprived themselves of. In making the orders asked for, to pay £1 each to the Company and 2s. cost of each summons, he advised them to see the Engineer, and again go to work.

Pure Water.—In the last session of the Deutsche Gesellschaft für Offentliche Gesundheitspflege, Dr. Falk described a new method of testing the purity of drinking water by electrical experiment. From researches carried out in the laboratory of the School of Artillery in Berlin, it appears that the conductive properties of water for the electric current vary rapidly according to its degree of purity, the resistance decreasing with the purity of the water. It is possible, in this manner, to detect with great ease the presence of small quantities of organic matter in water.—*Nature*.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Abstract of Report of Chief Gas Examiner.—The following are some of the particulars contained in the Report of Dr. Williamson, F.R.S., Chief Gas Examiner to the Metropolitan Board of Works, on the results of the daily testings of the gas supplied by The Gaslight and Coke Company, the South Metropolitan Gas Company, and the Commercial Gas Company, during the quarter ending Dec. 31, 1877:—

1. *With respect to Illuminating Power*—

Description of Gas and Testing-Place.	Min.	Aver.
The Gaslight and Coke Company—		
Common gas, Beckton	15·9	16·6
,, Friendly Place	16·0	16·4
Cannel gas, Millbank Street	20·0	20·8
Common gas, Devon's Road	16·0	17·1
,, Carlyle Square	16·3	17·6
,, Camden Street	16·0	16·6
,, Graham Road	14·7	17·1
,, Ladbroke Grove	16·1	16·8
South Metropolitan Gas Company—		
Common gas, Hill Street	15·7	16·8
Commercial Gas Company—		
Common gas, Wellclose Square	14·8	16·2
,, Parnell Road	15·9	16·9

It will be seen from these results that the average illuminating power at all the testing-stations has been above the requirements of the Acts of Parliament, and at some of the stations considerably so.

2. *As regards Purity.*—Sulphuretted hydrogen has not been present in the gas at any of the testing-stations. The proportions of sulphur in other forms than this were as follows:—

Grains of Sulphur per 100 Cubic Feet of Gas.

Description of Gas and Testing-Place.	Max.	Aver.
The Gaslight and Coke Company—		
Common gas, Beckton	19·1	13·4
,, Friendly Place	18·8	9·7
Cannel gas, Millbank Street	20·0	14·0
Common gas, Devon's Road	21·2	10·4
,, Carlyle Square	20·7	12·2
,, Camden Street	21·3	15·1
,, Graham Road	19·7	15·6
,, Ladbroke Grove	32·2*	17·4
South Metropolitan Gas Company—		
Common gas, Hill Street	24·0	13·8
Commercial Gas Company—		
Common gas, Wellclose Square	22·9	11·5
,, Parnell Road	25·7	20·2

* Unsatisfactory test.

It will be seen from these results that, with regard to sulphur, the average has at all the stations been better than required by the Acts of Parliament, and in most cases—especially Friendly Place, Devon's Road, and Wellclose Square—considerably so.

Ammonia has been present at all of the stations in greater or less quantity, but at Ladbroke Grove, Millbank Street, and Devon's Road it has appeared rarely—in the latter on one occasion only, and then to a slight extent. In no single instance was the parliamentary maximum reached.

Hackney District Board.—At the Meeting on Friday last, the General Purposes Committee reported that, in pursuance of reference, they had fully considered the report of the Surveyor upon the subject, and were not prepared to recommend the adoption of the average meter system in respect to the lighting of the streets in the district, but suggested that the number of burning hours should be reduced by lighting the lamps half an hour later in the evening, and extinguishing the same half an hour earlier in the morning. They had ascertained from the Police Authorities that this arrangement would not produce any inconvenience in the district, and at the same time would effect a considerable saving, and they recommended that an arrangement be made with the Gas Company for carrying this into execution. After some conversation, in the course of which it was stated that the plan now proposed was precisely similar to that which had for some time past been pursued in Islington, and found to work well, the recommendation was agreed to.

Report by Dr. Stevenson on the gas supplied by The Gaslight and Coke Company to the Vestry of St. Pancras, during the month of December, 1877:—Maximum light, estimated by sperm candles, according to the Act—17·1. Minimum light, sperm candles—16·6. Average light, sperm candles—16·8. Traces of ammonia, indicated by turmeric test paper—Traces on all occasions. Traces of sulphuretted hydrogen, indicated by lead test paper—None on any occasion. Sulphur 16·02 grains per 100 cubic feet of gas, on the average.

Dr. Whitmore's report on the illuminating power, pressure, and quality of the coal gas consumed in the parish of Marylebone during December, and supplied by The Gaslight and Coke Company:—

	Illuminating Power in Sperm Candles.			Mean Pressure in Tenths of an Inch.		Mean Quanty. of Sulphur in 100 Cu. Ft.	Mean Quanty. of Ammon. in 100 Cu. Ft.	Sulphuretted Hydrogn
	*Mean of 23 Obsers.	Highest.	Lowest.	Highest.	Lowest.	Grains.	Grains.	
Gas supplied from the Fulham works	16·14	16·31	15·60	20·47	9·06	18·40	0·46	No trace
Gas supplied from the Beckton and Bow works	16·18	16·74	15·62	32·85	17·06	16·00	0·46	No trace
Cannel gas supplied from the Pimlico works	20·13	20·80	19·24	21·43	11·47	18·06	0·36	No trace

Mean of daily readings of barometer . . . 29·78
,, ,, ,, thermometer . . . 54·79

* Each observation consists of ten readings of the photometer, at intervals of one minute.

The mean illuminating power of the three gases consumed in the parish was from one to two-tenths of a candle in excess of their respective standards, but all of them were observed at separate testings to be much more frequently below the standard than usual; the gas from the Fulham Works was eight times below the standard, that from Beckton and Bow was three times, and the cannel gas from Pimlico, was six times; this is most unusual, as it rarely happens that a deficiency of illuminating power occurs more than once, or at most twice in either of them. The amount of sulphur found in 100 cubic feet of the Fulham gas was a little over 18 grains, in the Beckton and Bow gas it was 16 grains, and in the cannel gas 18 grains; in neither of them did the ammonia amount to half a grain. The pressure of all the gases was good, and no trace of sulphuretted hydrogen was detected in either of them by the ordinary tests.

METROPOLIS WATER SUPPLY.

Metropolitan Board of Works.

At the Meeting on Friday last, the Works Committee reported upon a communication from the Kent Water-Works Company, transmitting a notice of their intention to give a constant supply of water in parts of the Parish of St. Nicholas, Plumstead, and of the Parish of St. Luke, Charlton, together with a plan of such districts, and stated "that the Committee see no reason to dissent from the proposal."

Mr. Watkins complained of the incorrectness of a statement made by Mr. Roche at the last meeting, to the effect that the Paddington Vestry had, upon a division, decided to support the Water Supply Bill of the Metropolitan Board, and that the letter to that body from the St. Pancras Vestry on the subject was ordered to lie on the table without being read. In consequence of that statement, he (Mr. Watkins) had written to Mr. James Flood, who was Chairman on the occasion, to ascertain whether it was true that the communication from St. Pancras, who had always been on friendly terms with Paddington, had, as asserted, simply been ordered to lie on the table. The reply from Mr. Flood was that no such order was made, but that the letter was duly received, and read by the clerk in the usual way.

A report was presented from the Fire Brigade Committee in reference to the alleged defect of the hydrants used at the recent fire in Cherry Tree Court, Aldersgate Street, on the night of the 4th inst. The Committee had inquired into the correctness of the statement, and the Chief Officer had made a report to the effect that at the fire in question three hydrants in Aldersgate Street were got to work, and were doing good service, when the pressure was found to fail, and engines were set to work instead. On inquiry, it appeared that the turncock had opened three of the old plugs in Aldersgate Street, running fast, and this serious mistake was the sole cause of the pressure failing. The Chief Officer further stated that the supply of water from the hydrants was perfectly good for six 1-inch jets, with a pressure sufficient to reach the highest building in the neighbourhood.

Mr. Edwards said that the failure in the pressure on these hydrants was solely caused by the turncock drawing these three plugs, and letting the water out from the main; but when the Board obtained possession of the water supply of the Metropolis, such a mistake would never occur again.

Mr. Runtz said if he understood this explanation, it appeared to him that had there been six hydrants instead of three the pressure would have been still less.

Mr. Rogers remarked upon the curious manner in which this case had been used by some parties as an argument in favour of the Board's Bill for a new supply, but said that inasmuch as it had been stated so repeatedly that the New River Company were at present supplying such a pressure of water as to render these hydrants efficient, it now appeared that upon the hydrants being at work the opening of three ordinary plugs to supply the fire-engines rendered the hydrants useless. He doubted whether Parliament would allow the Board to expend some five or six millions of money in providing an entirely new supply of water for the whole of London, in order that the required pressure might be secured for these hydrants.

Mr. Jones said he had lately had the privilege, by an invitation from the Corporation of London, of being present at a trial of hydrants in the City of London, which had proved most satisfactory. None of the hydrants threw water to a less elevation than 75 feet, and some of them reached upwards of 100 feet. He afterwards went to a trial of them at Bow, where he saw water thrown over the top of the railway station, and he could assert that their action was most efficient.

The report was agreed to.

Marylebone Vestry.—At the usual Meeting on Thursday last, Mr. Todd moved—"That the Parliamentary Committee be instructed to draw up a petition against the proposed Metropolis Water Supply Bill, with power to print the same, and forward copies to each member of the House of Commons; also to watch the progress of the Bill in the House, and to call on the Churchwardens to convene a public meeting of the Ratepayers, if considered necessary, in opposition to such Bill." He said the Vestry were, no doubt, aware that the first proposition in the Bill was to give a constant supply of pure and wholesome water, by sinking artesian wells. This was, he contended, a most Utopian scheme, because there was not the slightest necessity for it, inasmuch as they were already supplied with water as good as that proposed to be supplied. For instance, he saw, by statistics, that the West Middlesex Company supplied water as pure as that supplied by standard water, the Kent. Then the expense of the proposed scheme to supply the Metropolis with this super-excellent water would be enormous. There were 536,733 houses to be supplied, and to supply these houses, 2597½ miles of mains would have to be laid down; then each householder would have to provide a duplication of pipes in his house at a large expense, and this water was only to be used for drinking and culinary purposes. With regard to the cost of the works, the Metropolitan Board estimated it at 5½ millions, but that was simply an estimate. He had considered the subject, and he found that the work proposed to be done had cost the present Companies, who did their work as cheaply as possible, the sum of £11,556,843, and it was not at all likely the Board would do it at a less cost. Then it was proposed to lay down 75,000 hydrants, and to make other expensive alterations, and if the works were carried out as proposed, a rate of 10d. in the pound upon the Metropolis would be required, and he hoped the Vestries of the Metropolis would oppose the Bill, and prevent a frightful injustice being committed upon the ratepayers. The motion having been seconded by Mr. Verey, the debate was adjourned.

Dr. Frankland reports as the result of his analyses of the waters supplied to the Metropolis and some of its suburbs during December, that taking unity to represent the average amount of organic impurity in a given volume of the Kent Company's water during the last nine years, the proportional amount of such impurity in an equal volume of water supplied by each of the other Companies, and by the Tottenham Local Board of Health, was—Colne Valley 1·1, Kent 1·3, Tottenham 1·4, New River 3·0, East London 3·5, Southwark 5·3, Chelsea 5·3, Lambeth 5·6, Grand Junction 5·7, West Middlesex 5·9. The water drawn from the Thames by the Chelsea, West Middlesex, Grand Junction, Southwark, and Lambeth Companies was much polluted by organic matter, some of which was of most objectionable origin, and, although it was efficiently filtered by four out of the five Companies, it was quite unfit for dietetic purposes. The water delivered by the Grand Junction Company was slightly turbid, and contained moving organisms. The water of the Lea, as delivered after efficient filtration, by the New River and East London Companies was also polluted, although to a much less extent. The only good water supplied to London and the suburbs during December, and submitted to analysis, was obtained from deep wells in the chalk. It was distributed by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health. This water was bright, sparkling, wholesome, and palatable, and that portion of it delivered by the Colne Valley Company, having been softened by Clark's process, was not only of most excellent quality for dietetic purposes, but was also well adapted for washing. Seen through a stratum two feet deep, the water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board was clear and colourless; the East London Company's water was clear and nearly colourless; the New River Company's water, clear and very pale yellow; that distributed by the Chelsea, West Middlesex, Southwark, and Lambeth Companies, clear and pale yellow; and that by the Grand Junction Company, slightly turbid and yellowish brown.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	25·96	·257	·053	0	·216	·269	1·65	18·8
West Middlesex	27·16	·298	·053	0	·200	·253	1·60	19·9
Southwark and Vauxhall	29·54	·262	·050	0	·219	·269	1·55	21·2
Grand Junction	28·36	·269	·067	0	·205	·272	1·55	21·0
Lambeth	29·72	·283	·048	0	·266	·314	1·70	20·3
Other Sources—								
New River	28·96	·147	·031	0	·326	·357	1·55	22·4
East London	29·30	·166	·041	0	·024	·065	1·75	13·4
Kent	40·30	·062	·015	0	·524	·539	2·50	27·5
Outer Circle.								
Colne Valley	12·10	·050	·014	0	·309	·323	1·40	5·6
Tottenham Bd. of Health	44·00	·054	·027	0	·271	·298	3·15	25·0
Corporation of Birmingham*	27·82	·195	·048	·003	·374	·424	1·90	16·4
Corporation of Glasgow†	2·90	·207	·028	0	·006	·034	0·65	1·0

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

The Registrar-General publishes the following returns of the average daily quantity of water supplied by the London Water Companies during the month of December, 1877. According to these, 116,033,974 gallons, or 527,195 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight) were supplied daily; or 215 gallons (97·7 decalitres) rather less than a *ton* by weight, to each house, and 30·3 gallons (13·8 decalitres) to each person, against 29·3 gallons during December, 1876.

Companies.	Number of Houses, &c., supplied in Dec., 1876.	Number of Houses, &c., supplied in Dec., 1877.	Aver. Daily Supply of Water in Gallons* during Dec., 1876.	Aver. Daily Supply of Water in Gallons* during Dec., 1877.
Total supply	531,445	538,874	110,423,339	116,033,974
From Thames	250,648	254,179	56,032,761	57,864,383
„ Lea and other Sources	280,797	284,695	54,390,578	58,169,591
Thames.				
Chelsea	28,737	28,859	6,881,600	7,622,200
West Middlesex	48,680	50,135	9,533,505	8,913,001
Southwark and Vauxhall	80,705	79,440	17,820,000	18,210,000
Grand Junction	37,055	37,910	10,284,856	10,713,682
Lambeth	55,471	57,835	11,512,800	12,405,500
Lea and other Sources.				
New River	125,011	126,071	24,132,000	26,073,000
East London	110,334	113,192	23,849,800	25,215,650
Kent	45,432	45,432	6,408,778	6,880,941

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for December, 1877, as compared with that for the corresponding month of 1876, shows an increase of 7429 houses, and of 5,610,635 gallons of water supplied daily.

Dr. Whitmore's report on the composition of Thames Companies and other waters supplied to Marylebone during December:—

	In Grains, per Gallon.			In Parts, per Million.		In Degrees.	
	Total Solid Matter.	Loss by Incineration.*	Chlorine.	Free Ammonia.	Albumenoid Ammonia.	Hardness.	Hardness after boiling Fifteen Minutes.
West Middlesex	20·16	0·88	1·19	0·01	0·07	14·1	3·1
Grand Junction	20·80	0·80	1·18	0·01	0·08	14·4	3·2

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water. The total solid matter, *minus* such loss, consisted principally of carbonate of lime, with small quantities of other equally harmless salts.

The water of both Companies, as seen through a glass tube two feet in length, was clear and bright. The water taken direct from the River Thames at Hampton was in good condition.

The Pollution of Rivers.—On Wednesday last the annual meeting of the Association for Preserving the Rivers and Lochs of Scotland from Pollution was held in the Freemasons Hall, Edinburgh—Sir Robert Christison occupying the chair. The report of the Council stated that a number of towns were considering how the sewage therefrom was to be disposed of otherwise than by allowing it to go into the adjoining streams, and were in course of adopting measures for carrying out the Rivers Pollution Act of 1876. The Council recommended the members of the Association and other riparian proprietors to avail themselves of their rights under the law of Scotland for preserving the purity of the rivers and streams passing through their various properties. The Chairman, in moving the adoption of the report, said his opinion was that no one had a right to do anything that would pollute food, drink, or air. Every man had a right to receive these in a pure state, and it was the duty of the Legislature to see that they were not polluted. Every year he saw confirmation of the doctrine which he had taken the opportunity of enforcing on the Association at the commencement—that there was no manufacture in which a nuisance might not be prevented sooner or later, if the manufacturers applied a little of that ingenuity to the abatement of the nuisances which they had hitherto applied only to the extension of their manufactories. It was agreed to memorialize the Government as to the adoption of certain amendments, which were considered necessary to be made in the Rivers Pollution Act

THE MANCHESTER NEW WATER SCHEME.

A Special Meeting of the Manchester City Council was held on Wednesday, the 9th inst.—the MAYOR (Alderman Grundy) presiding.

Alderman GRAVE moved—"That this Council hereby confirms the propriety of the promotion by the Council in Parliament of a Bill for the purpose of empowering the Corporation to obtain a supply of water from Lake Thirlmere, in Cumberland, and for other purposes, the costs and expenses of such promotion to be defrayed out of the public funds or rates in the hands of the Council, or hereafter to accrue to them on the water-works account."

Alderman PATTESON seconded the motion.

Alderman KING opposed the motion, and, in a long speech, endeavoured to show that the scheme for obtaining water from Thirlmere was not a desirable one for the Corporation to proceed with. He said that no doubt the proper time for taking exception to the adoption of the scheme was in June last, when a report was presented to the Council showing what the intentions of the Water-Works Committee were in regard to Thirlmere. It must, however, be remembered that they had only had that report in their hands from the Saturday previous until the Wednesday when the meeting was held. At that time he raised an objection, and asked for further time to consider the subject. Alderman Curtis and other gentlemen joined him in that request, but the Council decided by a large majority to adopt the report at once. A question which meant the spending of millions of money on the part of the Council was deserving of more consideration than had been given to it. They could waste an hour or two in discussion as to whether they should charge sixpence extra for persons viewing the Town Hall because of the cost of having an additional policeman, but they could pass over as a matter of comparatively small importance, or at all events without giving members an opportunity of properly judging of its merits, this scheme, which would involve the Corporation in the expenditure of unknown millions. He repeated that it would involve the expenditure of "unknown millions." The ground for that haste could not have been that there was not time to allow another month on account of parliamentary exigencies, and even if it had been so, whose fault was it? The matter had been under consideration by a special committee for one or two years. During all that time it had been considered by the Committee, he had no doubt, carefully and well, but the proceedings of that Special Committee were not reported from time to time, like those of ordinary committees, to the Council. They had no means of checking their action from month to month. He merely referred to this to show that it was not his fault that the Council had not had time to discuss the question, but that it arose from the action of the Water-Works Committee. He was not going to touch on what was called the sentimental part of this question. The question he wanted to bring before the Council was the ratepayers question—to see how the scheme would affect the ratepayers. In the report to which he had alluded, the Council would remember, there was an extreme vagueness as to the capital likely to be required, the results they were likely to obtain, and he might say there was an entire absence of any statement as to the probable income and expenditure after the water had been brought from the lake. He complained that the Council had been kept in the dark upon these important matters. Moreover, no reason was given in the report why the Committee abandoned the scheme for obtaining a supply from Ulleswater, where there was abundance of water, although the estimated cost of carrying out the present scheme was something like £680,000 in excess of the estimate in the former case. He would, however, invite the attention of the Council to the earlier water-works scheme. He found that in 1848 the total estimated cost was £450,000, although in the first instance it was only to have been £300,000. They went on for a few years, and by the end of 1853 he found that the new works had cost £588,000, and it was reported that the Committee's borrowing powers were exhausted, that they wanted £15,000 to pay off some debts for land, and that Mr. Bateman said it would still require £35,000 to complete the works. The Council again applied to Parliament, and an Act enabling them to borrow £200,000 was obtained. In 1861 the Committee were still short of money, and consequently borrowed £195,000. In 1864 it appeared that that did not suffice to complete the works, and another sum of £195,000 was borrowed. A year later they were still short of funds, and therefore borrowed £100,000 more. He traced the different stages through which the works had passed, pointing out how the expenditure had gone on increasing until, in 1875, they applied to Parliament for power to borrow £500,000, a sum actually in excess of the amount that the works were estimated to cost in the first instance. If the original estimate had been so far exceeded in the past, what, he asked, might they expect in the future? And yet what security had they that they would not go on as aforetime? He had quoted the figures relating to the past, not as proving what would be the history of the future, but from a desire to let the ratepayers know what, by analogy, they should expect.

Mr. LAMB: Give the profits, and what the works are worth now.

Alderman KING said he meant to give the whole question as he had prepared it. If his information was defective it was not his fault, because he had done all he could to put himself in possession of the facts bearing upon this matter. He wrote to Mr. Berrey, the superintendent of the water-works, asking for certain information, but his request was not acceded to because the Committee passed a resolution not to furnish statistics to any person. With regard to the supply of water that might be expected from Thirlmere, as far as he could make out, from 26 to 29 million gallons was the utmost that the new scheme would give to Manchester. He deprecated the anxiety so frequently manifested to increase the sale of water outside the limits of the borough, contending that the result of that policy was seen in the fact, as he was informed, that the present supply would only last five years longer. Such was the state of affairs now that, with the highest domestic water-rate that was ever levied, and with a considerable sum of money for repairs being placed to capital account, the current revenue expenditure did not balance in the year 1876 by £10,500. They were losing £10,000 a year, and another £10,000 per annum was required for interest and reduction of capital, making £20,000 a year, which they would have to realize by extra sales before they got to the termination of their present supply. While the income had increased 47·7 per cent., the current expenditure had increased 55·3 per cent., thereby showing that the expenditure was going up at a greater rate than the income. If the Council persevered in the course they had adopted, of selling water for trading and other purposes, beyond supplying the people of Manchester who found the money and ran the risk, at prices which were considered utterly inadequate, in five years the supply would be exhausted. The £2,500,000 which they would then have expended would require them to raise £100,000 a year for interest and £25,000 for a sinking-fund. All this would have to be met after the new works had been constructed, and, supposing they adhered to their present policy, the increased income would only be from £30,000 to £35,000. They could not expect that the income would increase at a greater ratio than it had in the past eight years, nor could they anticipate that the expenditure would increase at a less ratio. He had been greatly astonished at these things, and if he had not had considerable experience he would have thought he had fallen into some strange mistake in his calculations. He was convinced, if the scheme was proceeded with, that practically by the time the new works were constructed the Water-Works Committee, as a committee, would be utterly insolvent, and that the ratepayers generally would have to be called upon in some way to make up the deficit. He felt it was absolutely necessary that a sharp and increasing pressure should be put to lessen and gradually abolish the supply of pure water for trade purposes, where other water would do, in the surrounding districts, and reserve it as far as possible for domestic purposes. If that were done he had no doubt the existing works would last for a great many years longer. He suggested that water might be got in some districts by sinking Abyssinian wells. If, however, they must go to the Lake district, let them go to where Mr. Bateman assured them they would get the best and the cheapest supply—Ulleswater. He concluded by moving as an amendment.—"That the discussion be adjourned for one month, and that in the meantime the Committee furnish the Council with estimates of the probable expenditure, the probable supply of water from Thirlmere, and also of the future financial position of the Water-Works Committee when the Thirlmere scheme is completed."

Alderman CURTIS seconded the amendment. He complained that the mover and seconder of the resolution had not adduced any reasons in its support. It appeared that the Council were not to have the information to which they were entitled from the Committee. He urged the desirableness of appointing a committee to carefully examine the statements made and conclusions arrived at by Mr. Bateman with reference to Thirlmere. If Mr. Bateman's statements on a former occasion had proved delusive, the Council ought not to place implicit trust in them now, but carefully inquire into them.

Mr. HARWOOD said that above all people Alderman King, as Chairman of the Gas Department, ought to have been silent on the question of committees keeping things secret. On other occasions Alderman King had, almost more than any other gentleman in the Council, sought to justify the means by the end, and that was the course which the Water-Works Committee had taken on this question. The Committee had more confidence in the ability and experience of Mr. Bateman than in the ability and experience of Alderman King. Mr. Bateman had said that 50 million gallons of water could be brought from Thirlmere, and that was against Alderman King's statement of 27 million gallons. The Committee had not relied merely on Mr. Bateman's wisdom and advice. They had engaged, during the past few months, the most eminent engineers and lawyers, who had examined the scheme in all its details. They all confirmed Mr. Bateman's report, and thus strengthened the hands of the Committee.

Alderman LAMB pointed out that the taking over of the water-works had not cost the ratepayers one penny, and that they were not now paying so much for water as they paid under the old system.

Alderman PATTESON said it was unfortunate that this discussion had taken place. The Committee had given all the information they possibly could. He was afraid that the discussion would weaken the hands of the Committee. There was a complete answer to all that Alderman King had said with regard to the increased cost of the old works, and as to the supply of water to the outside districts. He (Alderman Patteson) was prepared to go into every charge that had been made, but he did not think it was necessary then to do so.

Alderman MURRAY said if Alderman King had exercised a little more discretion, he would hardly have taken the course he had done. Had he been specially retained and entrusted with a brief on behalf of the opponents of the scheme, he could not have been more energetic. Alderman King, however, must not flatter himself that he was going to provoke the Chairman to reply on the whole question. The Chairman had been advised by the Town Clerk that nothing could be more injurious to the passing of the Bill than to disclose all the information that they were in possession of.

Mr. STEWART hoped that the Chairman would not commit himself by any reply, seeing that they would have to be met by Alderman King and others.

Alderman GRAVE said he was not going to make a formal reply to all that had been said. He wished, however, to say that the citizens had had every opportunity of judging of the merits of the scheme. They had been put in possession of all the accounts that could possibly be given to them; they had had the opportunity of reading the various reports on the subject; and they had seen the reports of the speeches made in the Council. They were convinced of the utility of the work, or they would have attended the public meetings and opposed it. To judge from some of the remarks made that morning, the Council would be launched into the condition of not being able to pay their way; but what was the fact? The closing of the Longdendale system would liberate a large amount of money that was now expended there, and which could be applied to the Thirlmere system. There was not a single thing that Alderman King had advanced which he (Alderman Grave) could not controvert; but he should act on the advice of the Consulting Town Clerk, and reserve all he had to say for the tribunal to which they would have to appeal. He feared nothing that Alderman King could divulge. He told him to his face that all along he had divulged many things which had been injurious—very seriously injurious—in a monetary sense, to that Council.

Alderman KING, who rose amid cries of "Vote," said: The charge has been made that I have divulged the secrets of this Council.

Alderman GRAVE: Of the Committee.

Alderman KING: I give the charge a most emphatic, utter, and absolute denial.

Alderman GRAVE: I had it from your own mouth.

The amendment was then put, and only four voted for it. The number against it was 47.

The original resolution was put and carried by 48 to 8.

THE PROPOSED PURCHASE OF THE BANGOR WATER AND GAS WORKS.—The ratepayers of Bangor have confirmed the resolution of their Local Board to proceed with the Bill for the compulsory purchase of the water and gas works. The poll showed a considerable majority in favour of the undertaking. The next step to be taken is the arrangement of the terms of purchase. The Company ask for £70,000; the Local Board offer £42,000.

GAS EXPLOSIONS.—A correspondent of *The Times*, referring to the recent fatal accident at Southport, says:—"Some months since you were good enough to insert in your columns half-a-dozen lines which I addressed to you, calling the attention of the inmates of houses to the precautions that should be taken upon the detection of an escape of gas. I then said that hanging in my kitchen was a card, upon which the following words were legibly written:—'In case of an escape of gas, immediately turn off at the meter, open all doors and windows, and call me.' In *The Times* of this morning I read another of these lamentable and fatal accidents, which so frequently result from the non-observance of this very simple suggestion. If you would again call attention to the easy way in which explosions might often be avoided, I believe that it would tend to the saving of life." A subsequent correspondent writes:—"Your correspondent, 'J.,' in his directions as to the precautions to be taken when an escape of gas occurs, omits the most important and essential one—viz., 'Do not take a lighted candle to explore the cause of the escape, or to find the gas-meter.' With this addition his suggestions may be of use."

MUNICIPAL FINANCE.

On the 12th ult., a Lecture on the above subject was delivered before the Manchester Statistical Society, by Mr. John Goodier, Registrar of Stock to the Manchester Corporation.

Mr. Goodier said the paper he had to submit to the Society had been suggested by the various discussions which had taken place on the subject of local taxation, and more recently by a startling paper in the *Economist*, on the expenditure and indebtedness of the great cities of America. He ventured to say at the outset that we had no reliable statistics published on which we could form accurately a complete idea of the financial position of the Local Authorities in this country, and that the Blue-Books to which statisticians naturally looked for guidance, published as they were by and on the authority of Government, were entirely misleading.

That the Government were perfectly aware of this fact was proved by the several alterations made during the past few years in the forms sent by them to the Local Authorities to be filled up, and more recently by the passing of the Local Taxation Returns Act, which was intended to secure uniformity and simplicity in the returns. The Local Government Board, in their last circular, dated September, pointed out that Municipal Authorities frequently omitted from their returns the expenditure and indebtedness of their gas and water works. He considered, however, that if the system of audit provided by law were faithfully carried out in all boroughs, ratepayers would have an efficient check upon the expenditure of their Town Council.

The Manchester return gave a full and accurate statement of the receipts and expenditure of the Corporation; it was published in one volume, and any ratepayer, upon the payment of a small sum, could obtain a copy at the Town Hall. The practice in other boroughs was to split up the receipts of the several departments, and publish each separately, so that it was difficult to ascertain from particular boroughs what the aggregate receipts and expenditure and the aggregate indebtedness amounted to at any period. He urged the desirableness of the Government appointing a Minister of Local Finance with a view to putting an end to the present municipal chaos, and suggested that the Municipal Corporations Association should take up the subject.

The table annexed, which he submitted for consideration, was, he said, in many respects most remarkable:—

Comparative Statement of the Population, Rateable Value, and Local Indebtedness of the undermentioned Boroughs and Cities, showing the Increase per Cent. under each Heading within the past Sixteen Years.

City or Borough.	Area in Acres.	Persons to an Acre, 1877.	Population, 1861.	Estimated Population, middle of 1877.	Increase per Cent.	Rateable Value, 1861.	Rateable Value, 1877.	Increase per Cent.	Municipal Rates, 1877.	Indebtedness, 1861.	Indebtedness, 1877.	Increase per Cent.
						£	£		s. d.	£	£	
Brighton	2,354	43·4	77,693	102,264	31	341,249	539,769	58	3 7*a*	143,300	262,557*c*	83
Wigan	2,188	—	37,658	39,110	3	72,516	125,000	72	—	138,247	365,153	164
Bolton	1,822	—	70,995	82,853	17	168,734	351,000	108	3 6	268,300	1,635,000*d*	509
Plymouth	1,395	52·3	62,599	72,911	16	127,582	180,000	41	3 7	88,600	168,309	89
Wolverhampton	3,396	21·6	60,860	78,389	20	298,785	396,623	32	4 7*a*	64,100	399,137*e*	522
Birmingham	8,400	44·9	296,076	377,436	27	845,427	1,352,556	59	4 4	534,754	4,635,890*f*	766
Leicester	3,200	36·7	68,056	117,461	72	141,000	321,000	127	4 6	96,849	269,963	178
Nottingham	1,996	47·6	74,693	95,025	27	232,848	450,000	93	3 3	36,130	192,137*g*	431
Liverpool	5,210	101·2	443,938	527,083	18	2,061,662	3,072,100	49	3 4*ab*	3,563,063	4,045,668	13
Manchester	4,293	83·7	338,722	359,213	6	1,203,500	2,229,186	85	3 5	2,058,743	4,644,477	125
Salford	5,170	27·3	102,449	141,184	37	352,905	750,229	112	1 8	126,777	1,032,285	714
Oldham	4,666	19·2	72,333	89,796	24	184,690	438,874	137	2 0	353,334	766,018	116
Bradford	7,290	24·8	106,218	179,315	68	302,920	813,490	168	5 4	756,238	2,826,132*h*	273
Leeds	21,572	13·8	207,165	298,189	43	504,885	1,033,133	104	—	588,495	3,331,056	466
Sheffield	19,651	14·4	185,172	282,180	52	446,866	827,205	85	—	Nil.	274,000	—
Hull	3,635	38·5	97,661	140,002	43	229,692	521,000	126	4 4	44,838	441,784	885
Sunderland	3,306	33·4	78,211	110,382	41	170,000	369,500	117	3 2	76,000	250,500	229
Newcastle-on-Tyne	5,371	26·5	109,108	142,231	30	316,948	710,613	124	4 6	173,341	501,967	189
Edinburgh	4,191	52·2	167,851	218,729	30	756,902	1,389,465	83	1 6	387,245	569,999*i*	47
Dublin	10,050	31·3	249,733	314,666	26	590,000	630,000	6	8 1	280,000	833,000	197
Totals	—	—	2,906,591	3,763,369	29	9,349,111	16,500,743	76	—	9,778,354	27,445,032	180

The figures relating to the population of Wigan and Bolton are taken from the Census Tables for 1871, as the Registrar-General does not include these towns in his report.

a Including water-rate. *ab* Exclusive of watch, museum, and school board rates levied by precept on the poor-rate authorities.
c Exclusive of the debt created in 1872 for the purchase of the water-works. *d* Includes purchase of gas-works, town-hall, and parks.
e Includes purchase of sewage works, town-hall buildings, public baths, &c.
f Includes purchase of gas and water undertakings, and a portion of improvement scheme under Artizans Dwellings Act.
g The large increase is due to extensive improvements having been made since 1861.
h The increase includes purchase of water, gas, and sewage works, parks, &c. *i* Including debt for improvement of markets and slaughter-houses, &c.

It would be seen from this table that the 20 places enumerated had, in 1861, a total rateable value of £9,349,111, which had risen to £16,500,743 in 1877. At the former period the aggregate local debt was £9,778,354, whilst it was now £27,445,032. The increased ratio of indebtedness between the two periods was therefore much greater than the increase in the rateable value; but in many cases—and notably in that of Manchester—the disproportion could be accounted for by the Corporations having purchased large private undertakings, such as gas and water works, or by their having expended large sums in the extension of such works, and others of a strictly remunerative character.

There were other circumstances to be taken into consideration in making, under this head, a fair comparison between different towns. It would be seen that the area of the borough of Manchester was only 4293 acres. The increase in the population during the 16 years was 6 per cent., whilst the increase in the rateable value was 85 per cent., and the increase of indebtedness 125 per cent. Of the increased debt nearly a million was due to the extension of the water-works, and this was necessitated by the demands of the outlying districts, whose populations looked to Manchester for their water supply, and whose wants as private consumers the Corporation were compelled to meet.

It was clear, therefore, that if the borough of Manchester had an area as large as that of Birmingham, and that if it included the adjoining townships of Moss Side, Rusholme, Withington, Levenshulme, Newton Heath, and Gorton—districts really part of the city of Manchester, and really populous, owing to the circumscribed area of the borough and the demand for warehouse accommodation within it—the increase in the rateable value would be much greater than the increase of indebtedness. All those townships, again, used the new Town Hall—the cost of which was another item in the last-named increase—for business purposes connected with the gas and water works. It was consequently clear that no contrast could be made unless it was accompanied with the capitalized value of the remunerative works of the several Corporations. Hence it was an error of statists—into which even Messrs. Rathbone and Whitehead had fallen—to measure the indebtedness of a borough with its rateable value. The table showed that Birmingham had a rateable value of £1,352,556, against Manchester, £2,229,186. The debt of Birmingham was now £4,635,890; but Manchester, with a rateable value of 64 per cent. more, had only about the same amount of debt. The Gas and Water Works of Birmingham had only recently been purchased, and it was not likely the Shareholders would sell those undertakings for less than their value, whatever they might be worth 20 years hence, so that the Birmingham Corporation's assets in those respects might be balanced against the liabilities.

It had been estimated by competent judges that the Manchester Gas-Works were worth at least £3,000,000, but the mortgage debt was only £405,502. The Manchester Water-Works were certainly not worth less than £3,500,000, while the value of the manorial rights and the improvement properties counted for another £1,000,000; so that upon a moderate estimate they had assets here, in real property, of 7½ millions, to secure a debt of little over 4½ millions, without taking into account the high rateable value of Manchester. The fact was, excluding the strictly remunerative works, the debt of the Manchester Corporation, including the debt for the new Town Hall, was only £852,000. It was no exaggeration to say that the financial transactions of the Manchester Corporation were not surpassed, even if they were equalled, by any other borough in the United Kingdom.

The table also showed that whilst the rateable value of Birmingham had increased 59 per cent., the increase of indebtedness was 766 per cent. within the same period. The rateable value of Hull increased 126 per cent., but the increased debt was 885 per cent. Bolton, Wolverhampton, Leeds, and Nottingham had each an increase of indebtedness of upwards of 400 per cent.; whilst Manchester, as already stated, was only 125 per cent., notwithstanding its large assets.

There were 229 municipal boroughs in England, and, excluding Edinburgh and Dublin, they had in his return a gross total of £26,041,033 owing by 18 boroughs. An analysis of the whole showed that the population had increased at the rate of 29 per cent., the rateable value at the rate of 76 per cent., and the indebtedness at the rate of 180 per cent.

It would be well indeed if those who dealt with the statistics of local government would inquire, not only what was obtained in return for the expenditure which they criticized, but how the respective Corporations viewed the important questions of capital and revenue, classifications which, under an imperfect knowledge of finance, had shipwrecked many apparently prosperous concerns. The Corporation of Manchester had nothing to fear from such an inquiry—rather the contrary—for it would be found upon examination that their views upon finance were as stable and sound as the commercial reputation and the credit of their prominent members.

Exeter Water Supply.—At the meeting of the Exeter Town Council on the 9th inst., a letter was read from the Dartmoor and Exeter Water Company, stating that they were willing to hand over their undertaking to the Council on payment of costs incurred, not exceeding £2000. A resolution was passed accepting the offer, and directing the Town Clerk to draw up an agreement for payment of the money, subject to the approval of Parliament; and it was also resolved to take no further steps with the Company's Bill.

Sewage Farming.—The West Derby Local Board of Health, whose district is one of the suburbs of Liverpool, utilize the sewage on a farm under their own management. It is not a profitable enterprise, according to the figures mentioned at the meeting of the Board on Wednesday last. It was then stated that the receipts from the farm during the season had been only £2853, whereas the anticipatory calculation was £5058. The year's loss on the farm was stated to be upwards of £4000, and during its six years existence the total loss had been about £20,000.

Sale of the Fenton Gas-Works.—At the meeting of the Fenton Local Board on the 1st inst., the Chairman said that since the last meeting of the Board some fresh information had come to the knowledge of the Committee who had considered the gas question. It seemed there was a mortgage of £350 upon the Gas Company, which the Board did not know previous to the late meeting, and that they would have to pay conjointly, as well as the expenses incurred in promoting the Bill, and these would be considerable. That was, perhaps, only what they might expect, as they were buyers and the Company were sellers, and there was a sense in which it was a compulsory sale, although, as a shareholder himself, he hardly saw it in that light. He moved a resolution to the effect that it was expedient to promote, and that the consent of the Board be given to the promotion of a Bill in Parliament in the ensuing session, in conjunction with Stoke, to acquire the works and undertaking of the Stoke, Fenton, and Longton Gas Company, the expenses to be defrayed out of the general district rate. The motion was seconded by Mr. Green, and carried.

BILSTON GASLIGHT AND COKE COMPANY.

The Annual Meeting was held on Monday, the 7th inst.—Mr. W. Hatton in the chair.

The Directors report stated that the trade account showed a profit of £9415 19s. 4d., which, with £1782 3s. 11d. brought from last year's account, made a total of £5198 3s. 3d. at the disposal of the Directors. This sum they proposed to appropriate as follows: — Half year's dividend paid Aug. 1, 1877, £1400; half year's dividend payable Feb. 1, £1400; one year's interest on debentures, £296 5s.; to reserve-fund account, £200; to carry forward to next year's account, £1901 18s. 3d.—total, £5198 3s. 3d. The Directors add "they have great pleasure in being able to present a favourable report of the Company's business during the past year, a period of almost unexampled depression of trade, in which Bilston has shared in common with other manufacturing towns. Considerable progress has been made in the erection of the new works; they were put in operation at the beginning of the present winter with satisfactory results. The railway siding, though not complete, has been made available for use, and when finished will effect a substantial saving in the cost of haulage of coal. A further outlay will be necessary next year for the erection of workshops, stores, and offices; when completed, the whole of the Company's business will be transferred to Millfields. The works at Moxley, and the land adjacent thereto, will then be for sale."

The trade account was as follows:—

	Dr.				*Cr.*	
Dec. 31, 1876—				Dec. 31, 1876—		
Stock	£424	3	9	Sales	£5,837	13 3
Purchases	3,335	0	3	March 31, 1877—		
March 31, 1877—				Sales	5,075	3 7
Purchases	2,433	9	7	June 30—		
June 30—				Sales	2,513	8 11
Purchases	1,737	11	5	Sept. 30—		
Sept. 30—				Sales	2,714	13 4
Purchases	1,882	12	7	Rents, &c.	49	18 11
Wages	2,300	1	0	Stock	153	10 0
Deterioration of works	560	0	0			
Allowances and bad debts	255	10	1			
Balance (profit)	3,415	19	4			
	£16,344	8	0		£16,344	8 0

The Chairman, in moving the adoption of the report, said it was very satisfactory to the Directors to be able to present one so favourable, under circumstances which had been peculiarly depressing to the trade of the neighbourhood. They had not suffered as a company to the extent to which the manufacturing interests generally had been affected. Probably this was because it took as much light to do a small business as it did for a large one. Another year they hoped, however, to announce an increase in their profits. No doubt the depressed state of trade had prevented an extension of their mains, and also an increased consumption, because everybody who could economize would, at such a time, do so, and would not add to their number of burners if they could possibly avoid it. The Directors were glad to say that considerable progress had been made at their new works, and, from the operations that had already been conducted there, very satisfactory results might be anticipated, among these being the probable removal to Millfields of the whole of the works during the year. He hoped it would not be very long before not only the Shareholders, but the town at large, would derive much advantage from the new works. He thought, indeed, that the town had already reaped, from those works, advantages in the shape of a better supply of gas. As the necessity arose, the Board would, from time to time, extend the mains in various directions, for they were convinced that, notwithstanding the new discoveries which had been made in means of illumination, the existing method of lighting by coal gas would still be in vogue for very many years to come, and would, indeed become more extensively used every year by all classes of the community. He hoped that before long the Company would realize the full dividend which the Act of Parliament allowed them to pay—viz., 10 per cent. For years past they had been self-denyingly content with 6 per cent. and 8 per cent., and as soon as such a course was advisable, the Directors would be glad to distribute the full amount.

Mr. Holcroft seconded the motion, which was agreed to.

Mr. Hickman moved—"That in addition to 4s. per share paid on the 1st of August last, a further sum of 4s. per share be paid, free of income-tax, on the 1st day of February next."

Mr. Holliday seconded the motion, which was agreed to.

Messrs. Baker, Colbourn, and George Edwards, retiring Directors, were re-elected, and Messrs. E. Ellis and T. S. Hatton were re-appointed auditors.

Mr. J. Rogers, in moving a vote of thanks to the Directors for their services during the year, said that the present condition of the new works showed that they had attended well to their duties.

The vote having been seconded by Mr. J. Price, and carried,

The Chairman acknowledged the compliment, remarking that the Directors heartily appreciated the confidence which the shareholders had placed in them for many years. Although a director himself, he could speak impartially concerning his colleagues, and could assure the shareholders that they had laboured hard to make the Company a success. Some of the gentlemen whom he could name as being specially qualified to do so, had bestowed great attention on the new works, and through them those works had been constructed with economy and efficiency, and not before they were required. Several years ago some of the Shareholders doubted the propriety of putting up new works; but now he believed all were agreed that such a proceeding had been warranted by what had since taken place. He moved that the thanks of the Shareholders be given to the officers of the Company for their efficient services.

Mr. Reeves acknowledged the same.

In reply to Mr. S. Thompson, the Chairman stated that the actual amount of bad debts for the past year was only about £30, which was mainly due to a joint-stock firm going into liquidation.

The usual compliment to the Chairman closed the meeting.

GAS EXPLOSION AT SOUTHPORT.

A fatal accident, arising from an explosion of gas, occurred at Southport on Saturday, the 5th inst., in a building attached to the residence of Dr. Lang, the Medical Officer of Health of the Local Board of Birkdale. The building consisted of two storeys, the lower one being let off as a school-room, and the upper one being used by Dr. Lang as a billiard-room. Having been told that there was a smell of gas in this room, Dr. Lang proceeded to ascertain the cause, and having unfortunately struck a match for the purpose of testing the fittings, a violent explosion of the gas which had accumulated in the upper part of the room immediately took place. The explosion caused the destruction of the roof of the building, and some of the timbers falling upon Dr. Lang, he was killed instantaneously. His daughter and a servant girl were also injured.

On Monday evening the Coroner (Mr. Driffield) held an inquest on the body, when the following facts were elicited:—

George Herbert Lang, aged 15, son of the deceased, said: On Saturday morning about half-past nine I was called down by my sister, who said my father wanted me. I went into the garden, and found him at the bottom, near the billiard-room building. He got on to a wheelbarrow from the outside, and broke a pane of glass in the school-room below, not being able to gain admittance, as it was let off to another person. He then opened the window, and went into the room, and turned off the gas from the meter. Returning the same way he went upstairs into the billiard-room, and I, my brother, and the cook followed. He got upon the billiard-table, and asked for a light. While the servant went to the mantelpiece to procure some matches, he took a box out of his waistcoat pocket, and struck a match, which I thought he placed to the top of the chandelier. The explosion took place immediately. Some plaster fell about me, but I was not affected by it otherwise than by feeling the heat. I ran out, and was followed by the cook and my brother, without noticing anything further. I did not return. When I first went up I noticed a smell of gas; but the windows in the billiard-room were opened. I was in the billiard-room the previous day, and then smelt gas, which caused me to examine the taps to see if they were closed.

Thomas Bond, gardener to the late Dr. Wood's family, said: When the accident happened I was in the saddle-room, which is directly opposite the building where the explosion took place. I heard a loud noise, which shook the floor as well as the building. I saw dust, burnt paper, &c., flying up, and I ran through the house into the street, and into Dr. Lang's garden. I first saw the children crying round the door, and they told me Dr. Lang was inside. I afterwards heard the servant crying for some one to come upstairs, stating that Dr. Lang was either dead or dying. I went up and found the doctor, who was lying across the billiard-table on his face, a piece of a spar being on one leg. His head was covered up with the *débris*, and I called for some men to come up. A spar lay across the back of deceased's neck, which I could not lift, as there was a great weight upon it. Eventually, with assistance, the spar was removed, and the doctor taken from under. He was quite dead, and we carried him into the house. I did not smell any gas. The roof had fallen in, so that the spars rested on the table, the chandelier being on the floor. I afterwards looked into the lower room, but perceived nothing.

Mr. *Robert Iddon*, Manager of the Corporation Gas-Works said: On Saturday morning, about 10.45, I went to the scene of the explosion, and found the upper portion of the premises wrecked. There was no escape of gas, and on examination I saw it was turned off at the meter. Afterwards I went into the upper room, and found the pendant lying on the floor, being broken from its connection at the top. I then examined the pendant more closely, and found the whole of the four taps turned off. I also noticed that the connection had only been soldered, instead of being brazed; and it is my opinion that at one time it had been used for a water-tap pipe. It did not fit properly, and had been covered with soap, which must have been used on several occasions. I think the gas had escaped and lodged between the slates and the roof, which, in the centre, would be about four or five feet in height. It had evidently formed a sort of magazine, which in all probability had been fired by the doctor's own match. I have also reason to believe that there was no gas chandelier before the doctor went to reside there. I have myself known of a case similar in every way.

The Coroner said that if the Jury chose they could have further evidence from the servant or the medical gentlemen; but he thought, from the evidence already given, they might dispense with that. The mystery was that the doctor turned off the gas at the meter, and then tried to find the leakage.

The Jury having decided that they were satisfied with the evidence given,

The Coroner, in summing up, said the explosive character of gas when mingled with atmospheric air was not generally known. People supposed that it was more dangerous the purer it was, whereas the reverse was the fact; the more it was mixed with atmospheric air the greater was the danger. He mentioned it at an explosion at Pemberton a few days previously. It was there stated by competent engineers that with gas—that was, pit gas, which was almost the same—an admixture of 5 per cent. of gas to 95 of atmospheric air, was at once explosive. Pure gas would not explode. They might take gas from a gas-pipe into a tin receiver, fill it, and then fire it harmlessly; but if they took the same receiver, and only put a little gas into it, and then applied a light, there would be an explosion. Consequently, gas mixed with air was the more dangerous, and in the space between the slates at the doctor's it would be mixed highly, for the slates could not be air tight. He (the Coroner) looked upon the strength of the explosion from the admixture as being very great. It appeared that after running upstairs the doctor smelt something, and opened the windows, thinking it the best thing to do. He then went down to the lower room and turned off the gas at the meter. Afterwards he must have returned upstairs, tried the gas on the spur of the moment, forgetting for the time that he had turned it off, and not thinking that there might be a magazine above. That fact had constantly been forgotten, even by gas men themselves. He (the Coroner) therefore thought that the verdict might be one of accidental death or misadventure, for he believed there was no blame attached to any one. He needed not to tell them that the doctor himself was a very scientific man, and a man whose experience was great, and in such a case, were he to see a similar case himself, he would be the first to note the mischief.

The Jury returned a verdict to the effect that the deceased had come to his death accidentally and by misadventure.

The sad event has caused a feeling of profound regret throughout the town, the deceased having taken a very active part in public affairs, and being much respected.

LIQUEFACTION OF OXYGEN.

On Christmas morning last a telegram from Professor Pictet, of Geneva, addressed to Professor Tyndall, appeared in *The Times* newspaper, announcing that, on the previous Saturday, M. Pictet had succeeded in liquefying oxygen under a pressure of 320 atmospheres by sulphurous and carbonic acids combined, at a temperature of 100° Cent.

On the next day an extract from the *Journal de Genève* was published in the same London paper, giving a somewhat detailed account of M. Pictet's experiment. Translated it was as follows:—

"One of the most interesting physical experiments of our time has been accomplished with great success in Geneva, in the laboratory of the Scientific Instrument Company. Our fellow-citizen, M. Raoul Pictet, has succeeded in obtaining, by the aid of ingeniously combined apparatus, the liquefaction of oxygen gas, one of the constituents of atmospheric air. This is briefly the mode by which this curious result has been achieved. By a double circulation of sulphurous acid and carbonic acid the latter gas is liquefied at a temperature of 65° of cold, under a pressure of from four to six atmospheres. This liquefied carbonic acid is conducted into a tube of 4 mètres in length. Two combined action pumps make a barometric vacuum in this acid which solidifies, owing to the difference of pressure. In the interior of the first tube, which contains the solidified carbonic acid, passes a tube of smaller diameter, in which circulates a stream of oxygen, produced by chlorate of potash, in a cylindrical generator with egg-shaped ends, sufficiently strong to avoid all danger of explosion. The generator will resist a pressure of 800 atmospheres. Yesterday morning (Dec. 22) all the apparatus was arranged as we have indicated, and when the pressure reached 300 atmospheres, a jet of liquid oxygen spirted from

the end of the tube at the moment when the compressed and frozen gas passed from this high pressure to the pressure of the atmosphere. That which gives great interest to the experiment is the experimental demonstration it affords of the mechanical theory of heat, and aiding as it does in the proof that all the gases are vapours capable of passing through the three states—solid, liquid, and gaseous. A fortnight ago M. Cailletet succeeded in liquefying the binoxide of nitrogen under a pressure of 146 atmospheres, and at a temperature of 11° of cold. After the experience of M. Raoul Pictet in liquefying oxygen, there remain only the two gases, hydrogen and nitrogen, to experiment upon. It is intended to repeat the experiments on Monday and the following days, with some slight changes of procedure and arrangement of apparatus."

Our contemporary, *Iron*, has published a translation of a further communication from M. Pictet, and the courtesy of the Editor of that journal has placed this translation and the accompanying illustrations at our disposal.

The apparatus employed and described by M. Pictet is the following:—A and B (fig. 1) are two double-action suction and force pumps, coupled together on the "compound" system, one creating a vacuum in the other in such a way as to obtain the widest possible difference between the pressures of suction and forcing. These pumps act on anhydrous sulphurous acid contained in the annular receiver, C. The pressure within this receiver is such that the sulphurous acid is evaporated at 65° below zero. The sulphurous acid is forced into a condenser, D, cooled by a current of cold water; it liquefies here at a temperature of 25° above zero, and at a pressure of about 2½ atmospheres. As it liquefies the sulphurous acid returns to C, through a small tube, *d*. E and F are two pumps similar to A and B, and similarly coupled. They act on carbonic acid combined in

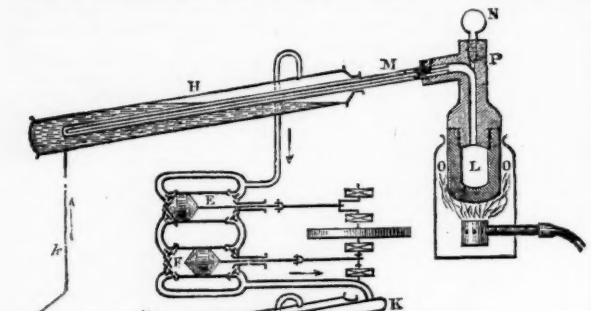


Fig. 1.

an annular receiver, H. The pressure in the latter is such that the carbonic acid is evaporated in it at 140° below zero. It is forced into the condenser, K, which is enclosed in the sulphurous acid receiver, C, which is itself at 65° below zero; the carbonic acid is here liquefied at the pressure of five atmospheres. It returns gradually, as liquefied, through the small tube K, to the receiver, H. L is a wrought-iron retort, thick and strong enough to resist a pressure of 500 atmospheres. It contains chlorate of potassium, and is heated to give off pure oxygen; its neck communicates with a slanting tube, M, made of very thick glass, and of the length of one mètre, which is surrounded by the carbonic acid receiver, H, itself at a temperature of 140° below zero. A screw tap, N, commanding the channel in the neck of the retort, opens an orifice, P, which communicates with the air. After the pumps, worked by an engine of 15-horse power, have been kept in action for several hours, when all the oxygen has been given off by the chlorate of potassium, its pressure in the glass tube is 320 atmospheres, and the temperature is 140° below zero. If the orifice, P, be suddenly opened, the oxygen makes a violent escape, which produces an expansion and absorption of heat sufficient to cause a liquefied portion to appear in the glass tube and spirt from its orifice if the apparatus be laid aslant. It ought to be added that the quantity of liquefied oxygen contained in the tube, which is one mètre in length and 0·01m in internal diameter, filled about two-thirds of it, and left it at the orifice, P, in the form of a jet of liquid.

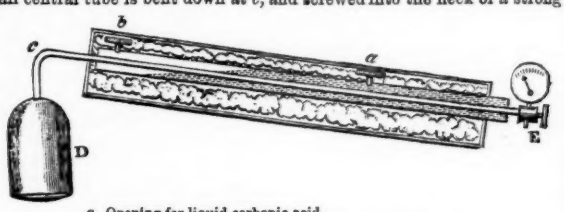
Writing to M. Dumas a few days after his successful experiment, M. Pictet says: "The end at which I have been aiming for three years past is to seek to demonstrate experimentally that molecular cohesion is a general property of bodies without exception. If the permanent gases resist liquefaction, we should have to conclude that their constituent particles do not attract each other, and are thus exempt from this law. To succeed, by experimental means, in bringing the particles of a gas into intimate proximity, certain indispensable conditions have to be complied with. These I summarize as follows:—1. To have an absolutely pure gas, free from any trace of a foreign gas. 2. To have at command very powerful means of compression. 3. To get an intense degree of cold, and the ability to abstract heat at these low temperatures. 4. To have a large surface of condensation maintained at these low temperatures. 5. To be able to utilize the expansion of the gas between the compression to which it is subjected and atmospheric pressure. This expansion, added to the preceding means, compels liquefaction. These five conditions being fulfilled, we may formulate the dilemma following:—When a gas is compressed at 500 or 600 atmospheres, and kept at a temperature of −100° or −140°, and then allowed to expand at the pressure of the atmosphere, one of two things must happen. Either the gas, obeying the action of cohesion, becomes liquid, giving up its heat of condensation to the portion of the gas which expands and is lost in the gaseous form; or, under the assumption that cohesion is not a general law, the gas passes into a condition of absolute inertness, and becomes a dust without consistence. The work of expansion would be impossible, and the loss of heat absolute.

"Knowing the absolute certainty with which thermodynamic equations can be reduced to fixed numerical forms, it occurred to me to contrive some mechanical means for realizing the conditions summarized above. The means which experiment has shown to be successful, I may describe as follows:—

"I took two suction force-pumps of the same design as those I use industrially in my ice-making apparatus. These I coupled so that the suction of the one corresponds to the compression of the other. The suction in the first communicates with a tube 1·10m. long, 12·5c. in diameter, filled with liquid sulphurous acid. Under the influence of a perfect vacuum the temperature of this liquid is rapidly lowered to −65° or even −73°, the extreme limit which has been obtained. In this tube of sulphurous acid there passes a second smaller tube, measuring 6 centimètres in exterior diameter, and of the same length as the tube in which it is enclosed. These two tubes have a common bottom. In the central tube I compress carbonic acid, manufactured from the decomposition of Carrara marble with hydrochloric acid. This gas was dried, then collected under an oil-gas holder containing 1 mètre cube. With a pressure varying between 4 and 6 atmospheres, carbonic acid is easily liquefied under these conditions. The fluid flows down by its own weight into a copper tube 4 mètres in length and 4 centimètres in diameter.

"A pair of pumps, coupled in the same way as the first pair, volatilize the carbonic acid in the gas-jar and the long tube filled with the liquid acid. Admission to the pumps is regulated by a three-way tap; a screw-regulating tap intercepts, if desired, the entry of liquid carbonic acid into the long tube; it is placed between the carbonic acid condenser and this long tube. When the regulating tap is closed, and the two pumps suck up the vapours from the liquid carbonic acid contained in the 4-mètre tube, the lowest temperature is produced that can be got; the carbonic acid solidifies, its temperature going down to about −140°. The work of abstracting heat is kept up by the pumps, which have a joint cylinder capacity of 3 litres per stroke and make 100 strokes per minute. Both the sulphurous acid tube and the carbonic acid tube are enclosed in sawdust and baize to prevent radiation.

"In the interior of the carbonic acid tube there passes a fourth tube, 5 mètres in length, 14 millimètres in external diameter, and 4 millimètres in internal diameter, which serves as the oxygen compresser. This long tube is surrounded by solid carbonic acid, and the whole of its surface is brought to the lowest temperature that it is in our power to obtain. These two long tubes are connected by the ends of the carbonic acid tube; the small tube goes beyond the other by about 1 mètre. This portion I bend towards the ground, giving both tubes a position slightly inclined, but still near enough to the horizontal, as shown in the sketch, fig. 2. The small central tube is bent down at *c*, and screwed into the neck of a strong



a. Opening for liquid carbonic acid.
b. Exit of vapours, corresponding with action of pumps.

Fig. 2.

cylindro-conical retort, made of wrought iron, the walls of which are 35 millimètres thick. Its height is 28 centimètres, and diameter 17 centimètres. This retort contains 700 grammes of potassium chlorate and 256 grammes of potassium chloride mixed together, melted, then pounded, and placed in the retort perfectly dry. I heat the retort when the double circulations of sulphurous acid and carbonic acid have lowered the temperature to the point desired. The chlorate of potassium is decomposed slowly at first, but tolerably rapidly at the end of the operation. A pressure-gauge at the end of the long tube enables me to watch the pressure and the progress of the reaction. It was made on purpose for me by Bourdon, of Paris, this last summer, and is graduated up to 800 atmospheres.

"When the reaction is finished the pressure exceeds 500 atmospheres; but it almost immediately falls, stopping at 320 atmospheres. If the screw-tap, E, at the end of the tube be opened at this moment, we may distinctly see a jet of liquid escaping with extreme violence. Closing the tap we get, a few seconds later, a second jet, this time less abundant. Pieces of charcoal, kindled at a small part of their surface, placed in this jet, ignite spontaneously with incredible violence. I have not yet been able to collect the liquid on account of the force with which it is projected; but I am now endeavouring to fit a cooled eprouvette, which, with the help of gauze, may enable me to collect a little of the liquid.

"Yesterday (Monday, Dec. 24, 1877), I performed this experiment a second time before a good part of the members of our Physical Society, and we had three well-defined jets, one after the other. I cannot yet give the minimum pressure necessary, for it is evident that I must have had an exaggeration of the pressure produced by an accumulation of the gas in the retort, which resisted condensation in the narrow space represented by the inner tube.

"It is my intention to attempt, with a similar apparatus, the condensation of hydrogen and nitrogen. My principal reliance is on my ability to maintain low temperatures with ease, by means of my four large pumps, worked by steam power.

"It is, I think, in this direction particularly that we have to strive to effect the condensations, which have hitherto opposed a stubborn resistance to our efforts; since the tension of saturated vapours are a direct function of the temperature. I am having a plan of my apparatus drawn up, and it will be my pleasure and duty to send it to you in the course of the week. I have learned with great interest that M. Cailletet has arrived at the same result with myself, and almost at the same moment. I have no idea as to what his process may be, but we shall doubtless be exchanging our ideas on the subject before long.

"I beg you to excuse the brevity of this description. I will by-and-by complete it by the addition of more precise details and equations, which will give these results a more scientific character."

M. Cailletet, an ironmaster at Châtillon-sur-Seine, claims also to have liquefied oxygen, and his report on the process we extract also from the columns of *Iron*:—

"Oxygen, or pure carbonic oxide, being enclosed in a tube of the form I have described in a former communication to the Academy, and being placed in the compression apparatus already exhibited before it, these gases being brought down to a temperature of − 29° by means of sulphurous acid, and at the pressure of about 300 atmospheres, those two gases retain their gaseous conditions. But if they are suddenly expanded, so as to produce, according to Poisson's law, a temperature of at least 200° below the initial temperature, we are immediately aware of an intense fog produced by the liquefaction, and perhaps solidification, of the oxygen or carbonic oxide.

"This phenomenon is observed also on the expansion of carbonic acid and the protoxide and binoxide of nitrogen when under strong pressure.

"This fog is produced with oxygen, even when the gas is at the common temperature, provided time is given for the escape of the heat it acquires by the mere act of compression. This I had occasion to demonstrate by experiments conducted on Sunday, December the 16th, at the chemical laboratory of the Ecole Normale Supérieure, before a number of scientific men, among whom were some members of the Academy of Sciences. I had hoped to find at Paris, together with the materials necessary for the production of a high degree of cold (protoxide of nitrogen or liquid carbonic acid), a pump capable of taking the place of my compression apparatus at Châtillon-sur-Seine. Unfortunately, a pump such as I wished for could not be found at Paris, and I was obliged to send to Châtillon-sur-Seine for the refrigerating material for collecting the condensed matters on the walls of the tube.

"To know whether oxygen and carbonic oxide are in a liquid or solid form in the fog, we should have to carry out an optical experiment of some difficulty, on account of the form and thickness of the tubes containing them. Some chemical reactions will also permit us to make sure that the oxygen is not transformed into ozone in the act of compression. These questions I shall endeavour to solve with the help of apparatus which I am now having made.

"Under the same conditions of temperature and pressure the most rapid expansion of pure hydrogen gives no trace of nebulous matter. I have, therefore, only nitrogen to study. The small solubility of this gas in water leads me to suppose that it will be very refractory to any change of condition."

Under date of Dec. 2, M. Cailletet had addressed the following note to M. H. Sainte-Claire Deville, a member of the Academy:—

"Without losing a moment, let me tell you, first of any one, that I have to-day liquefied carbonic oxide and oxygen. I ought hardly, perhaps, to say liquefy, for at the temperature obtained by the evaporation of sulphurous acid, *i.e.*, −29° and 300 atmospheres, I get no liquid, but a fog so thick that I may conclude it to be a vapour very near its point of liquefaction. I am writing to-day to M. Deleuil for protoxide of nitrogen, by the help of which I shall, no doubt, be able to watch the flow of a stream of carbonic oxide and oxygen.

"P.S.—I have just made an experiment of a very consoling nature. I compressed hydrogen at 300 atmospheres, and cooling at −28°, I expanded it suddenly. There was no trace of fog in the tube. My gases (CO and O) are therefore near upon liquefaction, this fog being produced only with vapours near liquefying. M. Berthelot's anticipations are, consequently, being completely realized."

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been very little business done this week in any branch of the iron trade, and the current inquiries are on so limited a scale that the prospects of the immediate future are the reverse of hopeful. In all directions the depression is so severe that ironmasters are endeavouring to reduce the wages of their workmen, who are now in a worse position in all respects than they have been for many years past. The puddlers of the Northfield Iron Company, however, have declined to agree to a reduction of 7½ per cent.; so that the Company who had intended to re-open their works have been compelled to forego that intention, and the men, instead of having half a loaf, will have none. At the Thorncliffe Iron-Works of Newton, Chambers, & Co., the whole of the blast furnacemen of all descriptions have been served with notices for a drop of 12½ per cent., which it is believed they will accept without demur, in order to keep, as they have hitherto been, almost fully employed. At the Milton and Elsecar Works of Messrs. Dawes the plant has been idle for some time, owing to a breakdown. The men there are consequently very badly off, and there is much distress. At Sheffield and Rotherham public soup kitchens have been opened, with a view of lessening the really serious distress that exists in all directions. The Stanton Iron-Works, Derbyshire, have been transferred to a limited company, having a capital of £600,000, of which £200,000 is held by two well-known bankers—partners in the old Company.

Pig iron prices remain quiet, and must continue so until the present stocks have been very largely reduced. North Yorkshire prices at the works now range as follows:—No. 1 foundry, 43s. 6d.; No. 2 foundry, 42s.; No. 3 foundry, 40s.; No. 4 foundry, 39s.; No. 4 forge, 39s.; mottled, 38s. 6d.; white, 38s.; refined metal, 57s.; Kentledge, 42s.; and cinder, 35s.; Derbyshire and South Yorkshire brands range from 40s. to 52s. 6d.

In the coal market there is little activity in any direction, despite the fair amount of briskness that characterizes the London and house coal trades. Prices are quiet, and the supply abundant. The Manver's Main Colliery is not unlikely to be closed, and it is rumoured that a general reduction of the miners wages will presently be attempted.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is only a languid demand for all descriptions of coal, and, notwithstanding the recent stoppage of the pits for the holidays, supplies continue abundant in the market, with a great deal of pushing in inferior classes of fuel, which are quite a drug, and for which, where sales are forced, extremely low prices have to be taken. For the best classes of round coal, such as good Wigan Arley mines, although the demand is very limited, prices, as a rule, are maintained; second qualities of house coal are also steady, as there is, if anything, a better demand for this class of fuel than for the first qualities. Any descriptions of fuel below these are, however, difficult to dispose of; the common sorts of forge and engine fuel being almost unsaleable. The average quotations at the pit's mouth may be given about as under:—Best Wigan Arley, 10s. to 11s.; common Arley, 8s. to 9s.; Pemberton four-feet, 8s. to 8s. 6d.; common Wigan mines, for house-fire purposes, 6s. 6d. to 7s.; common coal, for steam and forge purposes, 5s. 6d. to 6s. 6d.; good burgy, 5s. 3d. to 5s. 6d.; common ditto, 4s. 6d. to 5s.; good ordinary slack, 3s. 6d. to 4s.; and common ditto, 2s. 3d. to 3s. per ton. In the gas coal trade there is at present little or nothing doing beyond what is required for deliveries on account of contracts.

The shipping trade continues in an extremely depressed condition. There are very few inquiries in the market either for foreign or coastwise shipments, and to secure orders prices have to be cut down to the lowest possible limits.

In the iron trade there is still but little doing, and during the past week there has been but a very small inquiry for either raw or manufactured material. Local makers of pig iron, although they report inquiries in hand, are selling very little, and for delivery into the Manchester district their quotations remain at 51s. per ton for No. 3 foundry, and 50s. for No. 4 forge, less 2½ per cent. Outside brands are without material change, north country irons being still offered in this district at very low figures. Finished is, if anything, in a more depressed condition than pig iron, and makers all through the district are very badly off for orders. Whilst founders and engineers have, in many cases, nothing in hand beyond a little jobbing work. The average quotations for delivery into the Manchester district remain at about £6 5s. to £6 7s. 6d. per ton for Lancashire and Middlesbrough bars; £6 7s. 6d. to £6 10s. for Staffordshire; £4 6s. 6d. for Middlesbrough puddled bars; and £4 17s. 6d. for Lancashire and Staffordshire ditto; but prices, as a rule, are regulated by the nature of the specifications, and a considerable order for pipes, given out during the past week by one of the Local Boards in this district, has been placed at an extremely low figure.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

During the last week the Gas Companies began to enter upon the preliminary arrangements with the Durham Collieries for contracts to run over three, six, and nine months, and, in some instances, twelve months. Companies which have to pay a comparatively high rate of freight generally arrange for best gas coals, whereas those nearer the pits can select what they please. What may be called the official quotation for best gas coal is about 8s. per ton; but from all that can be learned, some contracts, at least, have been made at from 6d. to 1s. per ton within that figure for best. Medium qualities are quoted at about 7s. In the Durham coalfield there is a considerable quantity of coal wrought, which is used as second-class gas, second-class steam, or manufacturing coals indifferently. I stated last week that this somewhat large variety of coal was, on account of the strike in the Northumberland steam coal district, firmer, and they continue so. At the same time there was very little increase in the shipment of coals from the Tyne Dock last week; in fact, they were rather below the average of the middle of December. House coals are pretty steady in the market at late quotations—namely, 12s. to 12s. 6d. best house, and 10s. second. Though the Northumberland miners are still upon strike, and though there has been no official communication from coalowners to the miners, or from miners to owners, there has been some informal diplomacy, and, as we stated a fortnight ago, it is pretty certain that by the end of January an arrangement will be arrived at, and the Northumberland pits will be at work again. When the strike or lock-out occurred, best steam coals stood about 11s. per ton in the market. It is quite certain there will be a reduction in the wages of the workmen before they go in again. It may be the full 12½ per cent.; at any rate, it will be a substantial reduction. Under these circumstances there is every probability there will be a fall to 10s. per ton for best steam; and seconds will range from 8s. 6d. to 9s. 6d. This reduction might have an effect upon other branches of the coal trade; and as the Durham Collieries are now wrought with a sliding scale, there might be a slight fall in Durham gas coals as the days begin to lengthen again. At the present moment the best gas collieries are fully employed, and second-class pits are coming to the same standard. It is every way probable that this state of business will continue over January.

The tone of the freight market was just slightly improved last week. The gleam of hope given by the news of a proposed armistice occasioned a little more confidence in business circles; for if there should happily be peace, no doubt there will be considerable activity amongst the large fleet of iron screw steamers belonging to the North, in the spring of the year. If the Black Sea were opened, there would be a quick demand for coals from the ports which have been blockaded so long, and also a good business home. Confidence has been restored so far that no one thinks England will enter upon the war, suppose it should burst out again between the belligerents.

There is an abundance of tonnage in the market for the coasting trade. The following is the rate of freight for steamers:—London, 4s. 1½d.; Rouen, 6s. 6d.; Dublin, 6s. 6d.; Cork, 5s. 9d.; Havre, 5s. 9d.; Calais, 5s. per ton; Boulogne, 5s per keel. The manufacturers of the Tyne are doing very little forward business. What contracts have been made for chemicals over the year have been from £1 to 15s. per ton below the rates of last year. The real work of the year in the way of contracting will occur possibly in a fortnight hence, when merchants and manufacturers will be able to glean, from what has gone on in Parliament, some idea of the drift of the Eastern Question. In the meantime, affairs will go on pretty much from hand to mouth.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the usual Monthly Meeting of the Town Council of Renfrew, held on the 7th inst., it was resolved, on the recommendation of the Gas Committee, to reduce the price of gas from 5s. 5d. to 5s. per 1000 cubic feet.

The Police Board of Glasgow, at their last meeting, incidentally had the subject of lighting private streets and lanes under consideration. This arose out of a resolution, previously come to, to substitute No. 1 bat's-wing burners in the street-lamps for the single jet, or rat-tail burners, hitherto in use. Ex-Bailie Moir dissented from the resolution, because of the additional burden which the carrying out of the proposal would throw on the ratepayers. He was sorry to say that last year they had been out of pocket to the extent of £9000 for the lighting of common stairs and private lanes, which was solely for the improvement of private property; and he thought that between the lighting of private streets and lanes and the lighting of common stairs they would be as much out of pocket as would enable the inhabitants to adopt the Free Libraries Act without knowing that they did it. The convener stated that the burners which had been introduced into the lamps were only consuming 2 cubic feet of gas per hour, and that a great improvement had been effected by the change.

The usual report by Mr. J. F. King, on the quality of the gas supplied to the City of Edinburgh, was submitted to the Town Council, held last Tuesday. It showed that the illuminating power of the Edinburgh Company's gas was equal to 32 standard candles, and that of the Leith Company's gas stood at 27 candles.

Dr. Wallace's report on the illuminating power of the gas supplied in Glasgow during the week ending the 5th of January, shows that the minimum ranged from 25·02 candles in the northern district to 28·27 in the western; the maximum being as low as 26·76 candles in the northern district, and as high as 30·64 candles in the northern. In the southern or Tradeston district the range over the week was very trifling—average, 27·12 candles; maximum, 27·27 candles; minimum, 26·98 candles.

The Irvine Local Authority are beginning to get alarmed at the probable cost of the new water-works, which they have at present in progress. The original estimate for the works, by Mr. Leslie, C.E., was £26,500, and the sum of £24,000 had been borrowed and expended; and it was now thought that the works would eventually cost £38,000 or £40,000. Towards paying the additional cost the Joint Local Authority of the Halfway had already borrowed £7000, and the Irvine Local Authority resolved to borrow a like sum. Owing to the great cost, it is expected that the water-rate throughout the district will amount to 1s. 8d. or 2s. per pound of rental.

The total quantity of water in stock on the 1st of January for the Edinburgh and district water supply was 668,271,152 gallons, as compared with 700,678,753 gallons at the corresponding date last year, when the reservoirs were all full. The delivery was equal to 31·28 gallons per head per day to a population of 286,800.

It has been resolved by the Works Committee of the Dundee Water Commissioners to charge a uniform rate of 6d. per 1000 gallons for water

supplied by meter. Previously it was the rule to charge some consumers 4d. per 1000 gallons, and others a larger amount.

The Police Commissioners of Elgin have just been granted a supplementary loan of £2630 from the Public Works Loan Commissioners, for the completion of their new water-works.

At the last meeting of the Town Council of Musselburgh, it was resolved to give notice of their intention to borrow the sum of £14,000, being the probable cost of the water-works for a supply from Alnwick Hill; and it was announced that the Edinburgh and District Water Trust had stated to a deputation that the supply of water would be provided in less than eighteen months.

An excellent water supply scheme has just been completed for the town of Innerleithen, Peeblesshire. The water is brought into the town by means of cast-iron pipes, of a total length of 11,550 yards, and the entire cost of the works is estimated at £5000, for which there is a supply of 30 gallons per head per day for each of the population. It is expected that an annual rate of 8d. per pound of rental will be sufficient to defray the cost of the works. The scheme was devised by and carried out under the superintendence of Mr. Buchanan, C.E., Edinburgh.

The past week has been a very dull one in the Scotch iron trade. Contrary to the expectations entertained on Friday week, the price has fallen to 50s. 9d. cash, or 9d. per ton lower than was paid on the day referred to.

Reports regarding the coal trade in the West of Scotland are also still very discouraging. All descriptions of coal are very slow of sale, and at present everything seems to point to even still lower wages for the colliers.

Glasgow Water Supply.—Dr. Mills, F.R.S., of Anderson's College, Glasgow, reports that the water supplied to that city, during December, from Loch Katrine, was pale brown. There were plenty of muddy particles and a few fibres.

Birmingham Water Supply.—Dr. Hill, the Medical Officer of Health for Birmingham, reports that the water supplied last month to that town was bright, with a few suspended particles. It was rather harder than usual, and the nitrogen as nitrates was also higher, but the organic carbon was lower.

Halifax Corporation Gas-Works.—The Gas-Works Committee have just ordered a new scrubber to be erected by Messrs. Dempster and Sons, of Elland, from a design prepared by that firm. The scrubber adopted is 60 feet by 12, and is to be fitted with machinery-room 16 feet high, and also with Dempster's spreader, tippler, and engine. It will likewise have 6-inch by three-eighths boards from top to bottom.

Gas Lighting and Extinguishing by Electricity.—At the Metropolitan Board Meeting on Friday last, a letter was read from Mr. St. George Lane Fox, stating that the Vestry of St. James have given permission for his system of gas lighting to be applied to the lamps in Pall Mall, and inquiring whether the Board would allow the trial to be extended to the lamps on the Victoria Embankment. The letter was referred to a committee for consideration.

Midland Association of Gas Managers.—The first general meeting of the above was held at the Midland Hotel, Birmingham, on Thursday, the 10th inst., under the presidency of Mr. C. Hunt, of Birmingham. There was a good attendance, and several new members were enrolled. After confirmation and adoption of rules submitted by the Committee, the President delivered his Inaugural Address, a report of which will appear in our next number. The proceedings closed with a very cordial vote of thanks to the President.

Skelton's Catoptric Lamps.—Our attention has been called to a very considerable improvement which has been introduced in the construction of the reflectors for street-lamps on the catoptric principle, patented by Mr. Skelton. Heretofore the reflectors were made with silvered glass, the metallic backs being protected by various coatings. The certainty, however, of the silver oxidizing if exposed to the air, and the uncertain nature of all preservative coatings, rendered these otherwise excellent reflectors liable to deterioration and decay. Mr. Skelton appears now to have secured the most perfect durability by the use of a non-oxidizable metallized glass, having a reflective power little, if at all, inferior to that of silver, requiring no protection whatever, and not liable to be affected by expansion or contraction arising from variations of temperature. This improvement necessarily diminishes the expense of repairs very materially, and should render the use of these reflectors in the tops of all street-lamps a matter of ordinary practice.

Local Government Inquiry at Nottingham.—On the 2nd inst., Major Tulloch held an inquiry at the Town Hall, Nottingham, consequent upon an application by the Corporation to the Local Government Board for sanction to borrow £65,000 for sewerage works. There was no opposition to the scheme, which was explained at length to the Inspector by the Borough Engineer, Mr. M. O. Tarbotton. The application was for powers to borrow the above amount for works of outfall sewerage in connection with the extended borough; and with the area comprised in the powers of the late Nottingham and Leen Sewerage Act. There were 26 large plans prepared to be laid before and explained to the Inspector. The object is to permanently divert the River Leen into the Nottingham Canal, making water-tight the River Leen and the Beck outfall sewers, so as to prevent the extraneous water from mixing with the sewage and to alter the mode of discharge of the surplus water from the canal at various points into the outfall sewers. The chief work, however, is the construction of a gravitation outfall sewer from Sneinton to Stoke Fields, three miles in length, and which will include gravitation, syphon, iron sewers, and to carry the sewer from the high levels of the town of Nottingham into the gravitation outfall; also for the construction of gauge-chambers, valves, penstocks, overflows, and sundry other necessary works. In connection with this scheme it is also intended to rent about three-quarters of an acre of land in Eastcroft, on which will be erected a pumping-station, engines, and machinery. The gravitation outfall consists of a brick sewer 5 feet 3½ inches by 5 feet from Sneinton to Carlton Station. This will be constructed for about a mile in tunnel through Colwick Hill, and will be also partly over the ground and partly in excavation, while from Carlton station to Stoke Fields it will consist of a large concrete and brick sewer in the embankment constructed on the surface of the ground to the outfall at Stoke, where, as stated during the inquiry, the sewage will be irrigated and filtered.

Metropolitan Sewage.—An ancient and unsavoury proverb has been justified by Captain Calver's report on the condition of the lower Thames. As might have been expected, he has drawn upon himself a vigorous attack from Sir Joseph Bazalgette; but his statements are as difficult to dispose of as sewage itself. Mr. Mechi has rushed into the controversy with his theories concerning the utilization of sewage, and there is a kind of chance that the long dead-and-gone scheme for moistening the Essex marshes with sewage will sprout again in many fertile brains. It is a most humiliating and stern fact, not to be gainsaid, that the schemes hitherto brought forward for utilizing sewage on a large scale have failed, and failed egregiously; mainly, perhaps, because too much was expected of them. The sewage of villages may, perhaps, be distributed with advantage over the surrounding area of land under cultivation, but the mass of water in which the sewage of large towns is held in suspension is a prime difficulty in its disposition. This is a sufficiently damp country as it is, and the land will not receive the additional quantity of water sought to be thrown upon it. To dispose of the enormous mass of London sewage over farm land would cost far more money than the getting rid of it completely, and examples recently made public prove that experiments on a smaller scale are financial failures. When the Metropolitan Drainage Scheme was carried out, dreams of utilization were not yet completely dissipated, and the original idea of carrying the sewage down to the Maplin was unfortunately abandoned. It seems probable that this scheme will have to be carried out after all. There is no good reason why the foreshore of the lower Thames should not be occupied by a culvert down to the Maplin. The result would be the fertilization of a now barren and sandy tract. The effect of the system now in operation has been simply to remove the nuisance a few miles down the river, instead of hurling it into the sea at a point where it could give no offence. The engineering difficulties in the way of carrying the sewage of London down to the Maplin are very slight, and if the line of the foreshore were adhered to, the expense would not be enormous. Short cuts, involving the purchase of land, would, of course, involve unheard-of cost, and supply a stimulus to jobbery, but the simple expedient of utilizing the foreshore would obviate both the difficulties, and restore to the Thames the purity of pre-historic times.—*Iron*.

The Theory of the Radiometer.—In a recent lecture on the spheroidal state of liquids, Professor Barratt said: To Mr. Stoney is unquestionably due the great honour of being the first fully to explain the true theory of the radiometer. It was in the course of these investigations that Mr. Stoney has quite recently been led to show that the force which is so active in the high rarefaction (that is necessary for the effective rotation of the radiometer) is also present at ordinary atmospheric tensions. Now it is this force which forms the new explanation of the entire phenomenon of the spheroidal state. Prof. Barratt proposed to call it "Stoney's force." In order to understand the action that occurs, it must be recollected that, according to calculation, the number of molecules of air that at ordinary pressure occupies the space of a pin's head is 1,000,000,000,000,000,000; when the radiometer globe is exhausted of these molecules of air, as far as we can do it by mechanical means, there are still some few millions remaining, and these are in constant motion. Heat makes them move more rapidly, cold more slowly. If we have two surfaces very near each other, one surface hot and the other cold, from the hot surface the molecules will be thrown off with greater rapidity than they reached it; and if the cold surface be near enough, they will "bombard" it. Hence there will be a tendency in the hot and cold surfaces to retreat from one another, and when with one of these, as in the radiometer, this is possible, it ensues. This force would obviously disappear (1) if the residual molecules could be wholly removed or so lessened in number that their action would be insensible, or (2) if the surfaces were so far apart that the augmented molecular activity had expended itself before reaching the cool surface. Applying the same kind of reasoning to the spherical state of liquids, we can see that it is only at relatively short distances from the metal that the interaction will occur. A number of experiments were, in conclusion, shown, some with fluids from which there could be no vapour, such as the old theory requires, and others with fluids in which the difference in temperature was slight.

An Opening for a Gas Agitator.—At the ordinary monthly meeting of the Barton and Eccles Local Board, on the 7th inst., the question of the quality of the gas supplied to the district by the Corporation of Salford was again brought forward, a motion being made by Mr. Cowell that a competent person should be employed to test the gas "in the manner prescribed by law." The Chairman reminded the mover that when the Board waited upon the Salford Gas Committee and complained of the quality of the gas, the Committee asked them to authenticate their statements, but the Board were unable to do so. The Committee on previous occasions said, "It is very strange that you have, as you say, so many complaints, and yet you cannot authenticate them." Thereupon Mr. Bradburn, who seconded the motion, suggested that as the Board could not authenticate a single complaint, it would be well for the Clerk to write to the millowners and large consumers, and try if he could not "strengthen the Board's case." It was remarked by the next speaker (Mr. Parr) that if the millowners had any complaint they would most likely be prompt to make it without being solicited. The Clerk informed the Board that any sum which was spent in getting a test would be surcharged by the auditor, but he thought that the amount would be remitted by the Local Government Board. Mr. Gray was of opinion that if they had complaints from ratepayers, it would strengthen the hands of the Board in getting the gas tested. Unless they had evidence that the ratepayers had complained, and that they had been led by that to get the test, the Board would have very little ground on which to go before the Gas Committee with the result of such a test. The Salford authorities were spending a considerable sum of money in making improvements in the gas department, and he moved as an amendment that the Clerk should write to the Salford Gas Committee, informing them that the Board still had complaints concerning the gas supplied, and asking them for their observations on the matter. This amendment was, however, rejected, and, by a majority of two, the motion was adopted. As Dr. Angus Smith reports that the average illuminating power of the Salford gas during the last year was equal to 19·02 standard sperm candles, and it does not appear that the Salford consumers prefer any complaints, it seems difficult to understand what the Eccles and Barton Board have to complain of. Probably if the race of peripatetic "gas reformers" had not died out through sheer neglect of their pretensions, the good people at Eccles might yet be told what was the matter with them.

The Louisville Water-Works.—The large pumping-engines of the City Water-Works of Louisville, Kentucky, are on the Cornish plan. They are exactly alike, each working a single-acting lift and force plunger pump. The dimensions of the principal parts of the engines and pumps are as follows:—Steam-cylinder, 70 inches diameter; stroke of steam-piston, 10 feet. The beam for each engine is double; the two members, 3 feet 5 inches apart from centre to centre, are each 31 feet 10 inches long between end centres; 6 feet 9 inches deep in the middle, with 3 inch thickness of web, and 9 inches width of centre rib and outside flanges; the cylinder and pump ends of the beam are equal in length; each pair of beams weighs 42 tons. The beam vibrates on a main centre or shaft, 20 inches diameter, 9 feet 8 inches long, with journals 15 inches diameter, and 19½ inches bearing. The plummer blocks, for the beam centre of both engines, rest in pedestals bolted to a massive cast-iron entablature, which (extending transversely across the house and into the brick walls) is supported by four Tuscan columns of cast iron, standing on and anchored to the beam wall, by means of arched cast-iron bed-plates, built in the masonry. The piston-rods are guided by parallel motions, and the pump connecting-rods by cross-heads and slides; piston-rods 6½ inches diameter and 16 feet long each; pump connecting-rods 8 inches diameter and 28 feet long each. The pump-barrels are 36 inches in diameter each; plungers 36 inches diameter, with stroke same as steam-piston, 10 feet. The extreme lift of the pumps, when the river is at its lowest stage, is

21 feet 10 inches. The pumps are connected with the stand-pipe by two lines of 40-inch flanged pipes, provided each with a stop-gate near the stand-pipe. The pump-valves are of the kind known as Harvey and West's double belt-valve. The pumps and pump-mains to the stand-pipe have a circular water way of 40 inches diameter throughout, thus admitting the introduction of pump-barrels 40 inches in diameter, and increasing the present pump capacity 23 per cent. whenever the consumption of water will demand a greater supply than at present provided for. The metal (cast iron) of the pumps and pump-mains is from 2 to 3 inches in thickness, varying, as the forms vary, from the cylindrical to the oval or rectangular. All the joints are made with lead by means of flanges and bolts; the flanges are from 2½ to 3 inches thick, and from 4 to 6 inches wide, with 1¼-inch bolts. Each engine is provided with a battery of three single-flue Cornish boilers. The performance of the engines has been very satisfactory. The highest daily duty (calculated by the Cornish method) was 48,363,344 lbs. of water raised 1 foot high per 100 lbs. coal; the highest monthly average was 35,957,629 lbs., and the yearly average duty 30,217,865 lbs. Cost of the engines and connections complete, 117,753 dols. 64 cents.—*Scientific American.*

COAL AND ITS COMPONENTS.—Professor Barff's second "Juvenile Lecture," at the Society of Arts, was delivered on Wednesday evening last. It commenced with a few experiments, showing some of the properties of carbonic acid gas, which were omitted the previous evening, owing to the pressure of time; they consisted in the decomposition of carbonic acid gas by passing it through a tube containing red-hot potassium; the gas was decomposed, its oxygen uniting with the potassium, forming potash, and its carbon was deposited in the tube as a black mass. To show its density, carbonic acid was poured from one vessel to another, as water is poured; and a small air ball was placed in a tall jar, half full of carbonic acid, when on reaching the gas it remained on its surface, suspended, as it were, in the centre of the vessel. The lecturer then gave a description of the hydrogen compounds which can be obtained by heating coal out of contact with air, and first he explained the nature of pure hydrogen, how it is obtained from water by electrolysis, how also, from the same source, by the action on it of metals at different temperatures. He placed a small piece of potassium in water, which immediately decomposed some of it, the hydrogen which was set free catching fire and burning with a violet-coloured flame. He also explained briefly the action of red-hot iron on steam. After this, hydrogen was prepared in the ordinary way, by the action of zinc on oil of vitriol diluted with water. To show the lightness of this gas it was collected by upward displacement; also, a balloon filled with it ascended to the ceiling of the lecture-room. The non-luminosity of the hydrogen flame was illustrated, and the gas used in this experiment was afterwards passed through a vessel containing benzole, whereby it was rendered intensely luminous. This gave occasion for an explanation of how gases hold liquids in suspension, and how coal gas is rendered light-giving by the presence in it, and by the combustion of certain liquid hydrocarbons set free in the manufacture of coal gas. A miniature explosion was produced by a mixture of coal gas and air, showing the danger of allowing this gas to escape into rooms, and then bringing a light into contact with it mixed with air. A gas containing carbon and hydrogen, called olefiant gas, was next made, and several experiments performed with it to show the luminosity of the flame produced by burning it. Its power of uniting with chlorine and bromine was demonstrated, and an experiment was performed by passing coal gas through bromine water, which, originally brown, was discoloured by the gas, showing the presence in it of olefiant gas; thus proving that olefiant gas is a constituent of coal gas, and therefore a product of coal. Marsh gas was next spoken of, but was not prepared, owing to the short space of time at the lecturer's disposal. The composition of another compound of carbon and oxygen, which is obtained from coal—viz., carbonic oxide, was given, and some of the gas burned to show its characteristic blue flame, so well known as flickering over the surface of a bright and smokeless fire. The lecturer was assisted by Mr. J. H. Pearce, B.Sc., Lond.—*Society of Arts Journal.*

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

60.—HALL, J., Manchester, "Improvements in fluid injectors." Jan. 4, 1878.

72.—SMITH, W., Dublin, "Improvements in rendering concrete, artificial or natural stone, waterproof and air-tight." Jan. 5, 1878.

92.—EAST, W., Kingston-on-Thames, Surrey, "Improvements in the treatment of sewage and other waters for the purpose of purifying the same, and in apparatus employed therein." Jan. 7, 1878.

101.—PENNEY, J., Stockport, Chester, "Improvements in ferrule taps and in the method of connecting the same to steam, gas, and water-pipes, and in apparatus employed in effecting the connection." Jan. 8, 1878.

103.—SUGG, W. T., Westminster, "Improved apparatus for purifying illuminating gas." Jan. 8, 1878.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2743.—SMEATON, W. M. and J., Strand, London, "Improved mechanical arrangements for supplying water to tilt, tip, or swing basins, said mechanical arrangements or part thereof being capable of being utilized for preventing waste, and regulating the flow of liquids for various purposes." July 17, 1877.

2787.—TIDCOMBE, G., jun., Watford, Herts, "Improvements in means or apparatus for heating and ventilating greenhouses and other places by means of gas." July 21, 1877.

2934.—CLARK, A. M., Chancery Lane, London, "Improvements in electric lamps." A communication. July 31, 1877.

2982.—CLARK, A. M., Chancery Lane, London, "Improvements in electric lamps, and in the manufacture of the electrodes used therein." A communication. Aug. 3, 1877.

3541.—JOHNSON, E., Blackheath, and ROBEY, J., Greenwich, London, "Improvements in the manufacture of a filtering medium for the purification of water and other liquids." Sept. 20, 1877.

4252.—VAUGHAN, E. P. H., Chancery Lane, London, "Improvements in the production of combustible gases, and in the construction and arrangement of apparatus to be employed therefor." A communication. Nov. 14, 1877.

PATENTS WHICH HAVE BECOME VOID.

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

4410.—KIRKWOOD, J. T., LASCELLES, C. T. E., and HALL, J., "Improvements in the construction of gas-engines." Dec. 22, 1874.

4413.—POWELL, J. W., "Improvements in apparatus for regulating and controlling the supply and flow of water and other liquids." Dec. 23, 1874.

4486.—HASELTINE, G., "Improvements in the manufacture of enamelled pipes, pipe couplings, and other articles or apparatus exposed to the action of gases or liquids." Dec. 31, 1874.

PATENT WHICH HAS BECOME VOID.

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

3269.—DANCHELL, F. L. H., "Improvements in apparatus for treating sewage matter, and for filtering sewage and other water." Dec. 14, 1870.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

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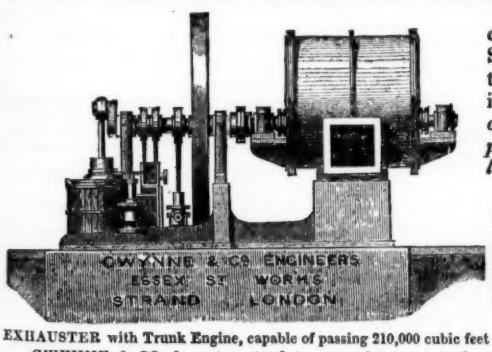

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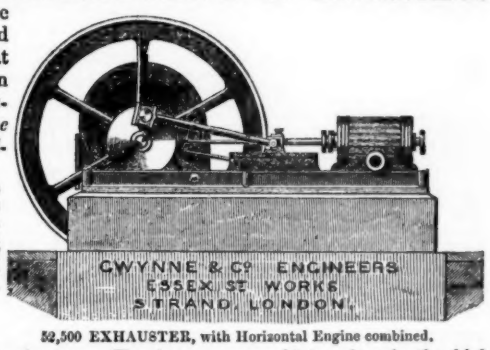
GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



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Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

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WANTED, for small Gas-Works near Bristol, a sober Man as Working MANAGER. Wages 18s. per week. House, coal, and gas free.
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WANTED, a Working Manager for the New Romney Gas-Works. There is a good cottage on the Works.
Apply, stating wages, &c., and for further particulars, to GILBERT ALLEN, Secretary, New Romney, near Folkestone, KENT.

WANTED, for the Seaham Harbour Gas-Works, a practical Man for Gas-Fitting, Pipe-Laying, &c. Wages 27s. per week, with a free house. None but steady men need apply, with references, to — WHYTE, on or before Thursday, the 17th inst.

WANTED, Orders for Samples to test the superior Silkstone, Wigan, and other Gas Coals and Cannel on Sale by G. J. EVESON, Gas Coal and Cannel Contractor, BIRMINGHAM.
N.B.—Prices on personal application, or by post or telegram, on shortest notice, and prompt delivery.

TO GAS AND WATER FITTERS.

WANTED, a competent Man, capable of laying Mains and Services and Internal Fittings, taking and testing Meters. Must have a knowledge of Water Meters, and be well recommended.
Apply, stating wages required, together with references, &c., to E. OWEN, Manager, Gas and Water Company, Mold, NORTH WALES.

WANTED, a situation as Working MANAGER or FOREMAN of a Gas-Works. Thoroughly understands the manufacture and distribution of gas, main and service laying, meter fixing, and index taking. Can set retorts and do all general repairs. Can have a good recommendation from the Secretary and Manager of the Rickmansworth Gas-Works.
Address J. HARDY, care of the Manager, Gas-Works, Rickmansworth, HERTS.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.
John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

GAS-WORKS Contractors and Engineers require efficient CLERK and DRAUGHTSMAN.
Address WILLIAM BLEWS and SONS, BIRMINGHAM.

A Young Man having experience in making up the Accounts of Gas Companies, and having also a technical knowledge of the manufacture and distribution, desires an ENGAGEMENT. Unexceptionable references.
Address No. 432, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Young Man, who has had several years experience in a Gas-Works, desires a SITUATION. Is well acquainted with the manufacture and distribution of gas, and has a thorough knowledge of chemistry. Excellent testimonials.
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A Practical Engineer, with large ex- perience in the construction and designing of Gas Apparatus, Roofs, and General Engineering, desires an engagement as CHIEF DRAUGHTSMAN or ASSISTANT ENGINEER.
Address H., Waterloo Terrace, New Hampton Road, WOLVERHAMPTON.

SUPERINTENDENT OF GAS-WORKS.

THE Directors of the Gravesend and Milton Gaslight Company are about to appoint a SUPERINTENDENT of their Works at Gravesend. He will be required to have a thorough practical knowledge of Gas Machinery and Works, and the manufacture of Gas, and also to have had experience in the actual working of Gas-Works.
Particulars of the duties of the office can be seen at my Office, 27, King Street, Gravesend, or can be had upon application, enclosing stamped addressed envelope for return.
The salary will be £200 per annum, with house at the Works, coals, and gas.
Letters from candidates, enclosing testimonials as to character, ability, and previous service (which testimonials will be returned on application and enclosure of stamps), must reach me on or before Wednesday, the 30th of January next, after which date an appointment will be made with those candidates whose attendance may be required before the Directors.
TUFNELL SOUTHGATE, Secretary.
Gravesend, Jan. 10, 1878.

REMOVAL.

CHARLES HEISCH, F.C.S., Analytical and Consultimg Chemist, Superintending Gas Examiner to the Corporation of London, &c., &c., has REMOVED from 8, Savage Gardens, to 79, MARK LANE, where he may be consulted as usual.

ON SALE—One Station-Meter, to pass 1000 cubic feet per hour. Almost new. Will be sold cheap.
Apply to J. HALL, Gas-Works, St. Helen's, LANCS.

FOR SALE, One Gasholder, 33 ft. by 14 ft., with cast-iron tank, columns, girders, inlet and outlet pipes, and valves.
Apply to Mr. JOHN BUDDEN, Gas-Works, Poole, DORSET.

TO BE SOLD, together or in Lots, THIRTY SHARES, of Ten Pounds each (fully paid up), in the King's Lynn Gas Company, established by special Act of Parliament.
Apply to Messrs. HARWAR AND CO., Furnival's Inn, LONDON, E.C.

T. V. CLARKE & CO., Trundley Lane Wharf, Surrey Canal, Deptford, S.E., are BUYERS of Tar and Ammoniacal Liquor; also of Sulphate of Ammonia.

SECOND-HAND SCRUBBER WANTED.

THE Directors of the Lurgan Gaslight Company wish to PURCHASE a good Second-hand SCRUBBER for their Works. The quantity of Coals used is about 1200 tons per year.
Parties wishing to offer will please state the dimensions, how long in use, name of maker, and price.
By order,
WILLIAM BAIRD, Secretary.
Lurgan, Jan. 7, 1878.

GAS PLANT FOR SALE.

THE Directors of the Newcastle and Gateshead Gas Company have FOR SALE the following ARTICLES lately used at the Gas-Works, Blaydon—viz.:
One Scrubber, 18 ft. high and 8 ft. diameter.
Set of Condensers, consisting of six 14-in. pipes, with bridge-pipes.
Three Purifiers, 7 ft. 6 in. square, and lifting apparatus.
21 5-in. Ascension-Pipes.
54 ft. Hydraulic Main, D-shaped, 18 in. by 18 in.
One Gasholder, 35 ft. diameter.
Four Columns for do.
One Station-Meter, 5-in. inlet.
One Governor.
With other necessary connexions, all of which may be seen at the Gas-Works, Blaydon.
Further particulars may be obtained from the undersigned, to whom written offers, either for the whole or part, should be sent on or before the 29th inst.
WM. HARDIE, Secretary.
Neville Street, Newcastle-on-Tyne, Jan. 2, 1878.

BOROUGH OF BARROW-IN-FURNESS.

THE Corporation are prepared to receive TENDERS for a GASHOLDER of 125 ft. diameter, and the ironwork connected therewith.
The plans and specification may be seen, and all necessary information obtained, of the Manager, at the Gas and Water-Works, on and after the 22nd inst.
Sealed Tenders, addressed "The Chairman of the Gas and Water Committee," and endorsed, to be delivered at the Municipal Offices not later than Jan. 29, 1878.
The lowest or any tender not necessarily accepted.
By order,
C. F. PRESTON, Town Clerk.
Municipal Offices, Barrow-in-Furness,
Jan. 11, 1878.

TO GASHOLDER MAKERS, &c.

THE Directors of the Northampton Gas Company are prepared to receive TENDERS for a Telescopic GASHOLDER, 100 feet diameter by 30 feet deep.
Plans and specifications may be seen at the Offices of the Company on and after Monday, Dec. 31, and copies of the specification and particulars may be obtained on payment of One guinea.
Tenders, addressed to the Chairman, endorsed "Tender for Gasholder," to be delivered at the Office of the Company on or before Wednesday, Jan. 24.
The Directors do not bind themselves to accept the lowest or any tender.
JOHN EUNSON, jun., Engineer.
Northampton, Dec. 21, 1877.

TO IRONFOUNDERS & GASHOLDER BUILDERS.

THE Directors of the Devonport Gas and Coke Company are prepared to receive TENDERS for the erection at their Works of a TELESCOPIC GASHOLDER and Iron TANK, about 80 ft. diameter and 24 ft. in depth.
Plans and specifications may be seen at the Offices of the Company, where copies of the latter may be had on application. Tracings of the set of drawings will be forwarded on receipt of P. O. order for One Guinea.
Tenders are to be sent in on or before Monday, the 28th inst., endorsed "Tender for Gasholder and Tank," and addressed "To the Chairman, Devonport Gas and Coke Company, Devonport."
The Directors do not bind themselves to accept the lowest or any tender.
JOHN WILLING, Secretary.
Devonport, Jan. 1, 1878.

DEVIZES CORPORATION WATER-WORKS.

CONTRACT No. 5.
RESERVOIR, ENGINE-HOUSE, ETC.

THE Town Council of the Borough of Devizes (acting as the Urban Sanitary Authority) are prepared to receive TENDERS for the construction of a Covered RESERVOIR, ENGINE and BOILER HOUSES, and other Works connected with the above Contract.
Plans and specifications may be seen at my Office in Devizes, or at the Office of the Engineer, Mr. Henry Tomlison, 4, Bene't Street, Cambridge, and bills of quantities can be obtained on payment of One Guinea each.
Tenders (endorsed "Water-Works, Contract No. 5") must be sent to me on or before Monday, the 21st inst.
The Corporation do not bind themselves to accept the lowest or any tender.
A. GRANT MEEK, Town Clerk.
Devizes, Jan. 2, 1878.

Will shortly be ready, price 18s., bound in cloth, gilt lettered,

THE THIRTIETH VOLUME
(JULY to DECEMBER, 1877,)
OF THE
JOURNAL OF GAS LIGHTING, WATER SUPPLY, AND SANITARY IMPROVEMENT.

Now ready, price 5s., by post 5s. 3d., cloth, 8vo., gilt lettered,

SULPHUR COMPOUNDS IN GAS.

A full Report of the Evidence given before the Select Committee of the House of Commons on the Bills of The Gaslight and Coke Company and the Crystal Palace District Gas Company in the present Session.

LONDON: W. B. KING,
11, BOLT COURT, FLEET STREET, E.C.

Price 1s., on stout paper, in stiff paper cover,

ANALYSES OF SCOTCH COALS, CANNEL, SPLINT, SHALE, &c., USED in the MANUFACTURE of GAS. By WILLIAM WALLACE, Ph. D., F.R.S.E., F.C.S., &c., Public Analyst and Gas Examiner for the City of Glasgow.
LONDON:
WILLIAM B. KING, JOURNAL OF GAS LIGHTING Office, 11, BOLT COURT, FLEET STREET, E.C.

STAINES AND EGHAM DISTRICT GAS AND COKE COMPANY, LIMITED.

TO GASHOLDER MAKERS.

THE Directors of this Company invite TENDERS for the supply and erection of a TELESCOPIC GASHOLDER, with two lifts of 18 ft. each; the outer lift to be 50 ft. 6 in. in diameter.
Tenders, marked "Tender for Gasholder," to be sent to the Secretary on or before Saturday, the 26th of January inst.
The lowest or any tender will not necessarily be accepted.
The plans and specification may be seen at the Secretary's Office, at Staines, and further information obtained of him, or of the Manager, at the Gas-Works at Egham.
JOHN ANTHONY ENGALL, Secretary.
Staines, Jan. 4, 1878.

TO BUILDERS AND IRONFOUNDERS.

THE Buxton Local Board invite Tenders for the following Works:—
1. The erection of superstructure of Retort, Coal, and Coke House, &c., in Ashwood Dale, Buxton.
2. Wrought and Cast Iron Work in Iron Roofs over Retort-House and Stores, Cast-Iron Beams and Columns in Floors, &c.
Bills of quantities may be had, and plans and specifications seen, at the Gas-Works, Buxton; at the Offices of the Engineer, Mr. Henry Lyon, Barton House, Deansgate, Manchester; or at Messrs. Mestayer and Gunson's, Architects and Surveyors, Marsden Street, Manchester.
Tenders, endorsed "Gas-Works No. 1 or No. 2," as the case may be, to be sent in, addressed to the Chairman of the Gas Committee, on or before Thursday, the 24th inst.
The Board are not bound to accept the lowest or any tender.
By order,
JOSIAH TAYLOR, Clerk.
Local Board Office, Buxton, Jan. 7, 1878.

DUKINFIELD AND DENTON JOINT GAS-WORKS.

TO IRONFOUNDERS.

THE Committee of the above Company are prepared to receive TENDERS for the supply of the following Cast-Iron PIPES, with turned and bored joints, to be delivered at Ashton and Denton Stations as required:—

2550	yards of	8	inch, in	9	feet	lengths, more or less.
1550	,,	8	,,	12	,,	,,
1550	,,	10	,,	9	,,	,,
1550	,,	10	,,	12	,,	,,

All to be coated with Dr. Smith's solution, and weight per yard to be duly specified.
Further particulars may be obtained on application to the undersigned, to whom tenders are to be sent, endorsed "Tender for Gas-Pipes," on or before Monday, Jan. 28, 1878.
The Committee do not bind themselves to accept the lowest tender.
By order,
WILLIAM BRIDGE, Gas Manager.
Gas Offices, Dukinfield, near Manchester,
Jan. 14, 1878.

TO HYDRAULIC, GAS, & HOT-WATER ENGINEERS, FIRE-ENGINE MANUFACTURERS, LOCAL BOARDS, CONTRACTORS, PLUMBERS, AND OTHERS.

The Valuable STOCK of the late Firm of Beck and Company, Limited, comprising about 20 Tons of Gun Metal, Brass and Iron Fittings, removed from No. 130, Great Suffolk Street, Borough, S.E., by order of the Liquidators.

MR. BILLINGAY will Sell by Auction, at Taylor's Depository, near the Elephant and Castle, S.E., on Thursday, Jan. 17th, and following Day, at one o'clock prompt, the above, including Steam and other Cocks, High-pressure Valves, Gauges, Grease Cups, Syphons, Fire and Sluice Cocks, Hose Fittings, Stand Posts, Street Boxes, Hydrants, Road Watering-Posts, Deep Well, Force, and other Pumps, Iron, Gas, and Water Piping, Lavatory, Bath, and Closet Fittings, and a variety of other Goods of a like character.
May be viewed two days prior and on mornings of Sale. Catalogues at place of Sale; of Mr. E. GREATHEAD, Accountant, Moorgate Street Chambers, MOORGATE ST., E.C.; and of Mr. BILLINGAY, Metal Trades Valuer and Auctioneer, 64, King William Street, LONDON BRIDGE, E.C.

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NOTICE.

THE GAS & WATER COMPANIES DIRECTORY, 1878.
(WATER SECTION.)

The Editor will feel greatly obliged if Secretaries and Engineers would fill up, and return to him at once, the forms sent them, as the work is now going to press. If any have not received Forms, they will be forwarded immediately, on application to the Editor,

CHARLES W. HASTINGS,
8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.

PATENT HYDRAULIC LIFTS, CRANES, HOISTS,
Suitable for Lifting Purifier-Covers, &c.

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CONSISTING OF
Tables, Rules, and Useful Information for Gas Engineers, Managers,
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COAL GAS.

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THE
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Being a Ruled Account-Book with Printed Headings, and Analyzing Guide for Keeping, upon the easiest and most correct method, the Expenditure of a Gas Company, in accordance with the provisions of the Gas-Works Clauses Act of 1871, and suitable for all Companies.
Published by EDWARD SANDELL, Accountant, 2, Great George Street, WESTMINSTER, and W. B. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

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Associate of the Society of Accountants in England,
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Mr. ROBERT DEMPSTER, Sen.,
CONSULTING GAS ENGINEER,
Of Messrs. Robert Dempster and Sons, Rose Mount Gas Engineering Works,
ELLAND, near HALIFAX,
May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Our R. D., Sen., having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations, is both extensive and reliable.

TO INVENTORS AND PATENTEES.
MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
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Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.
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CATHELS'S Improved Retort-Settings. Guaranteed to heat and wear well, with great economy of Fuel.
Coloured lithograph copies of Working Drawings of Beds of One to Seven Retorts (so clearly arranged and fully shown as to be easily understood by any retort setter or bricklayer) having been made of these valuable settings, they can now be supplied with detailed Specification immediately on receipt of orders.
Apply to Mr. THOS. NEWBIGGING, Consulting Gas Engineer, 5, Norfolk Street, MANCHESTER.

THE UNIVERSAL GASLIGHT IMPROVEMENT COMPANY,

LIMITED.

CAPITAL, £100,000 STERLING, IN 10,000 SHARES OF £10 EACH.

Subscriptions are invited for 5000 Shares of £10 each, or £50,000 of the Capital of the Company.

Deposit of £1 per Share on application. Future Calls will be made as required, and as the Progress of the Company warrants, but at intervals of not less than Three Months.

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ROBERT KING, Esq. (Messrs. Hurlet and Campsie Alum Company), Glasgow.
ALEXANDER DONALDSON, Esq. (Messrs. James Watson and Co.), Glasgow.
S. STEWART, Esq., Manager, Gas-Works, Greenock.
HENRY AITKEN, Esq., Falkirk.

SOLICITORS—Messrs. MONCRIEFF, PATERSON, FORBES, and BARR, 45, West George Street, Glasgow.

CONSULTING CHEMIST—Dr. WALLACE, F.R.S.E., F.C.S., Public Analyst and Gas Examiner for the City of Glasgow.

SHAREBROKERS—Messrs. M'COWAN and HOUSTOUN, 87, St. Vincent Street, Glasgow.
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BANKERS—THE CLYDESDALE BANKING COMPANY, GLASGOW, AND BRANCHES.

SECRETARY (*pro tem.*)—Mr. A. M'D. HOUSTOUN, 87, St. Vincent Street, Glasgow.

PROSPECTUS.

This Company has been formed for acquiring, working, leasing out, selling, and granting licences for, and also for erecting apparatus for working Patent No. 2587, July 24, 1874, granted to Henry Aitken, Falkirk, for Improvements in the Manufacture of Illuminating Gas, and in the Apparatus or Means employed therefor; and Patent No. 2725, Aug. 3, 1875, granted to Henry Aitken, Falkirk, and William Young, Clippens, Renfrewshire, also for Improvements in the same.

The objects of these patents are the treatment of Gases in their condensation, or cooling down, so as not to allow the Tars to take from them the Naphthas or lighter Hydrocarbons, upon which, in a great measure, their illuminating power depends; or the treatment of the Tars in such a way as to give up to the Gases such portions of the Hydrocarbons as they may have absorbed. Further, the augmentation of the quality of Gases of low illuminating power, produced from common Coal, &c., by the application of Hydrocarbons produced from Shale, Oil, &c.

The leading advantages of the present inventions may briefly be stated as follows:—

1. Gas of a higher illuminating power is obtained from any Coal or Shale than formerly, so that gas manufacturers making Gas from common Coal only can most materially increase the illuminating power of their Gas at the same cost for Coal.

2. Gas manufacturers making Gas of a high illuminating power are enabled to do so from cheaper Parrot Coal, common Coals, and Shales, dispensing with the use of high-priced Cannels. And

3. A saving of cost in the purification from less Lime being used.

The inventions have been before the Gas community for more than a year, and have been favourably criticized; and inquiries have been made by Gas Managers both at home and abroad with a view to their adoption.

The first-mentioned Patent has been in operation on a large scale for more than a year, at Hamilton Gas-Works, and during that time the whole Gas Supply for Hamilton has been treated under the Patent. It has given the Gas Committee of the Corporation every satisfaction.

The process as conducted at Hamilton has been investigated by a Committee of the West of Scotland Association of Gas Managers, and also by Dr. Wallace, Gas Examiner for the City of Glasgow.

The reports made by these authorities show that, as compared with the old mode of working, the illuminating power of the Gas under the new treatment is increased, taking the average results of the trials, by 18¼ per cent., or, in other words, the illuminating power of the Gas is increased by 4⅓ candles.

It was found also that the cost of purifying under the new system was considerably less than under the old, the saving in Lime alone being about 12 per cent. It is, therefore, as testified by Dr. Wallace in his Report, "undoubtedly a great step in the art of Gas-making."

Patents have also been secured in most of the continental countries, and in India and Canada, which have all been included in the sale to the Company, and the Company may also, under their constitution, acquire or take out, in the United Kingdom or abroad, patents in addition to those specified above, for future inventions or discoveries in connection with improvements in the manufacture of Gas or other illuminants and relative apparatus. As the quantity of Coal made into Illuminating Gas in the United Kingdom alone is estimated to be 10 million tons per annum, there is a very wide field for the operations of the Company, with every prospect of a profitable result.

Intending subscribers are referred to the Report on the process by a Sub-Committee of the West of Scotland Association of Gas Managers, and to the discussion thereon at the Association's meeting, as contained in the JOURNAL OF GAS LIGHTING of the 15th and 22nd of May, 1877, and copies of Dr. Wallace's Report may be had on application to the Solicitors or the Brokers.

An agreement has been entered into between Henry Aitken, of Falkirk, in the county of Stirling, Coalmaster, *of the first part*; and Andrew M'Dowall Houstoun, 87, St. Vincent Street, Glasgow, on behalf of the Company, *of the second part*; dated the 13th of September, 1877, containing the terms on which the Company acquire the above-mentioned Patents, and all prolongations thereof or improvement thereon. It can be seen in the hands of the Solicitors, but it may be mentioned that its principal conditions are—

1. Payment to Mr. Aitken of sums he has expended in taking out and working the Patents, amounting to £1800.

2. Mr. Aitken to get 5000 paid-up shares of the capital of the Company, but to reap no benefit therefrom in any year till the holders of the 5000 ordinary shares for which subscription is now asked shall have been paid 10 per cent. per annum on the amount called up; after which Mr. Aitken's shares w draw, on an amount equal to that paid-up on the ordinary shares, a dividend at the same rate, and thereafter the shares will rank, equally. And

3. So soon as the holders of the 5000 shares for which subscription is now asked shall have been paid in dividends an amount equal to their called-up capital, with interest at the rate of 10 per cent. per annum on the same from the dates of the calls, the distinction between Mr. Aitken's shares and the others shall cease.

Applications for shares to be made in the following form:—

TO THE DIRECTORS OF
THE UNIVERSAL GASLIGHT IMPROVEMENT COMPANY
LIMITED.

GENTLEMEN,—Having paid to the credit of your Company with the Clydesdale Banking Company the sum of.....
Pounds, being £.....per share on my application for.....A Shares of £10 each in your Company, I request you to allot to me that number of Shares; and I hereby agree to accept the same, or any less number that may be allotted to me, and to pay the balance in respect thereof when called on, in terms of the Prospectus and Articles of Association; and I further authorize you to place my name upon the Register of Shareholders for the Shares so allotted.

Name (in full).....
Address.....
Profession (if any).....
Date.....
Signature.....

Since the above prospectus was issued, an apparatus to work the process has been ordered by the Gibraltar Gas Company.

The Northampton Gas Company are erecting, or are about to erect, an apparatus to test the process at their works for themselves.

The Patents for the United States have now been secured, and several companies there are working the process (see *American Gas Journal* of the 3rd of December last). The working of the process there proved that not only was there a large increase in the illuminating power of the Gas, but also that all trouble with Naphthaline was avoided. This, although only what was expected, is most important, as Naphthaline is a great source of trouble and expense to nearly all gas-makers over the world, except in Scotland.

An apparatus has been erected for working the process at the Glasgow Corporation Gas-Works at Dalmarnock, and the gas made has been frequently tested by Dr. Wallace, Gas Examiner for the City of Glasgow. His report gives results which confirm those got at Hamilton. A copy of this report is annexed.

The Share List will be closed on Monday, the 21st inst. Applications for shares to be made in the above form.

Universal Gaslight Improvement Company, Limited,
87, St. Vincent Street, Glasgow.

REPORT ON THE "AITKEN" PROCESS OF GAS MANUFACTURE,

As carried out at the Glasgow Corporation Gas-Works, Dalmarnock,

By Dr. WALLACE, F.R.S.E., F.C.S.,
Public Analyst and Gas Examiner for the City of Glasgow.

An apparatus for the practical trial of Mr. Aitken's process of Gas Manufacture having been erected at the Corporation Gas-Works, Dalmarnock, I have been engaged during the last two months in making a series of experiments, with the view of testing the utility of the invention. The apparatus was a complete gas-work, and was fitted with exhauster, scrubber, &c., exactly as in a large work. The coals were distilled in seven retorts, and each charge consisted of 12 cwt. of coal. Each trial lasted from 24 to 72 hours, and the coals used were Provanhall and Braehead. The average of four trials of the ordinary process gave 9053 cubic feet per ton of coal, of an illuminating power of 26·28 candles, while five trials of the Aitken process gave 9464 cubic feet per ton, of an average illuminating power of 30·04 candles, showing a gain in quantity of 411 feet, or 4·5 per cent., and in quality of 3·76 candles, or 14·3 per cent. This result is eminently satisfactory, and fully bears out the figures obtained in former trials made at the Gas-Works at Hamilton, demonstrating clearly that by this process a very rich gas can be made from moderate-priced second-class coals. As regards permanency, I am satisfied that the gas is sufficiently stable for all practical purposes, and does not differ essentially from gas of equal richness made by the ordinary process of gas manufacture.

Glasgow, Jan. 9, 1878. WILLIAM WALLACE.

ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

For Jointing and Repairing Retorts and Ovens *in* action and *out* of action.

A Pamphlet on the advantages of the above, with modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

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CHARLES HENRY STREET AND BISSELL STREET, BIRMINGHAM.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

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WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

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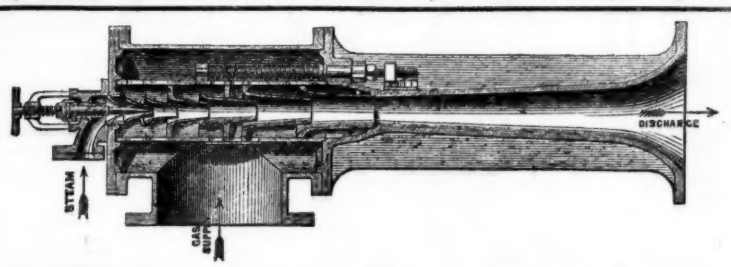

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IMPROVED CLELAND'S PATENT.

UPWARDS OF 250 IN USE.

CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

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17, LANCASTER AVENUE, MANCHESTER,

OR TO

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SOLE AGENT FOR ENGLAND AND WALES.

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ELLIS LEVER & CO., Central Coal Offices, 46, Cannon Street, London, E.C., and 6, Piccadilly, Manchester, are prepared to contract for the supply of THE BEST CLASSES of CANNEL and GAS COAL, for long or short periods. Analysis and Prices on application.

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AND

6, PICCADILLY, MANCHESTER.

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CONSULTING GAS ENGINEER,

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Plant, Tools, Stores, and all requisites for Gas and Water Works: Gasholders, Purifiers, Scrubbers, Roofing, Sashes, Retort Fittings, Grids, Socket-Pipes, Lamp-Posts, Wheelbarrows; Brasswork, Chandeliers, and Gas-Fitters Tools; Liquor-Pumps, Valves; Clay Retorts and Fire Goods, &c.

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All negotiations respecting M. Brémond's patented process for preventing Deposits of

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in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Gas-Works, VERSAILLES, near Paris, who may be consulted upon all matters connected with the Gas Industry.

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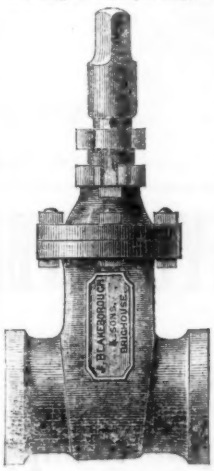

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HILL and CO., Gas Engineers and Architects, 11, Appach Road, Brixton Rise, S.W., prepare Designs for the construction of New Gas-Works, Bridges, and Roofs, or for the remodelling and extension of existing Works. Also provide Drawings of all kinds of Gas Apparatus and Plant. Drawings, Tracings, and Specifications copied for Engineers and Contractors.

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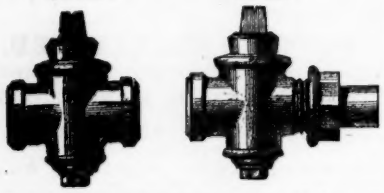
WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

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CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

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Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.

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Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

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STANDARD WASHER AND SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

The Exposing of a large Amount of Effectually-wetted Surface (which is continually reproduced) to act upon the Gas.
Unerring Regularity in the Distribution of the Liquor.
Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.
Economy of Space, thus enabling the Apparatus to be protected from the Weather.
Economy of First Cost and of Maintenance.
It works without Pressure.
It is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

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GAS ENGINEERS,

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it. The interior is fitted with an arrangement of perforated sheet-iron plates—the holes being about 1-20th of an inch in diameter—so contrived that the gas, in its passage through the Washer, has to pass through two sets of these perforations, whence it emerges in a succession of minute bubbles into the liquor in which the perforated plates are immersed. This minute division of the gas in contact with liquor results in the complete removal of all particles of tar, and it at the same time not only increases the ammonia strength of the scrubber and condenser liquor, which is all made to flow through the Washer in a constant stream, but it enables the liquor to combine with and to remove from the gas a much larger proportion of other impurities—notably, carbonic acid. This effect is due to the liquor in the Washer being kept in active circulation and in intimate contact with the gas for a prolonged period.

This Washer is intended to work in conjunction with a scrubber. It occupies a small space, and is inexpensive.

It has been in successful constant use for nearly three years, and examination has proved that the perforated plates neither become clogged with tar nor corroded by the action of the liquor or gases. It gives three inches of pressure, and only needs a constant stream of liquor to keep it in regular action without any further attention.

For Particulars and Prices apply to

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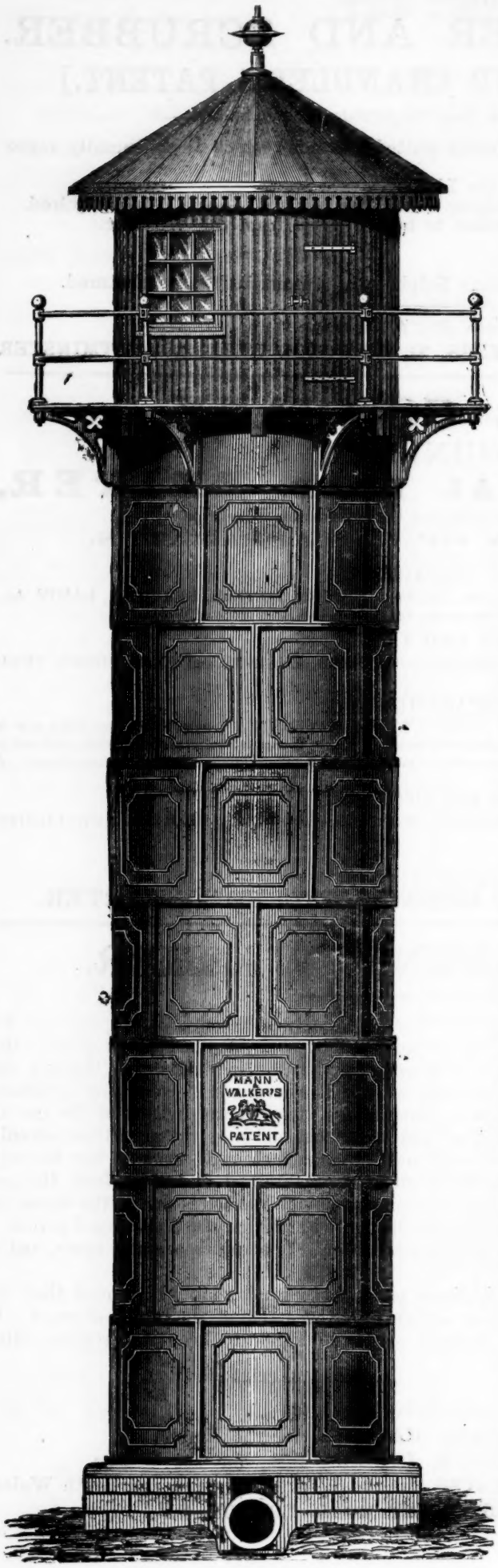
Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.



C. & W. WALKER,
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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re- quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,
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SOLE AGENT FOR
THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

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General Ironfounders and Makers
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CAST-IRON GAS AND WATER PIPES.
Sizes 1¼ to 15 inches.

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GAS PURIFICATION.

BAILES & HALLSWORTH,
CONTRACTORS FOR THE
PURIFICATION OF COAL GAS
BY THEIR
PATENT HYDRATED PEROXIDE OF IRON MATERIAL.

The Material is adapted specially for taking up sulphuretted hydrogen, and will simultaneously absorb any ammonia that may pass the scrubbers.

The spent oxide resulting from our Material is more valuable than that from natural oxide of iron, and manufacturing chemists buy it in preference.

The Material has now been in use during the past three years in most of the principal Gas-Works in Yorkshire and elsewhere.

It contains considerably less moisture than natural oxide of iron, and is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

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J. & J. BRADDOCK,

GLOBE METER-WORKS,
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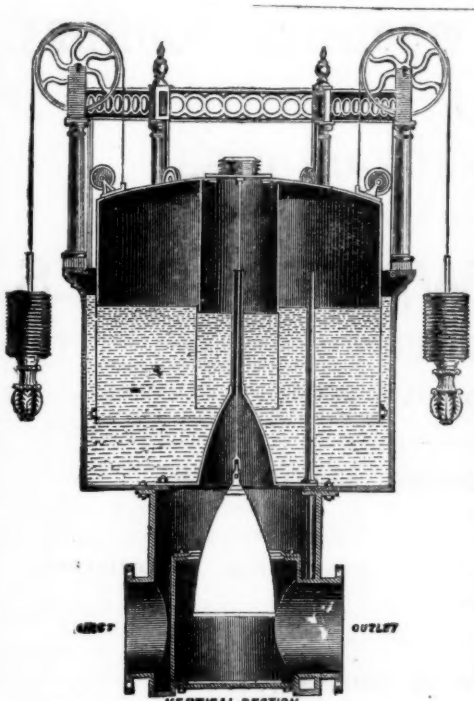
Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

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LOTHIAN'S CANNEL
Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL
Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL
Yields 13,320 cubic feet of 32·5-candle gas per ton.
Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Established 1840.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or export Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

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T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9806 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

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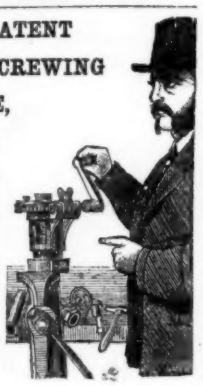
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

ADDISON POTTER,

WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of
CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

GRIRDROD'S PATENT
PORTABLE PIPE SCREWING MACHINE,



For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

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Brassfounders, Gauge Injector and Tool Makers,
ALBION WORKS, SALFORD,
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HYDRAULIC CRANES & HOISTS,

Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

HYDRAULIC RAMS FOR LIFTING AND LOWERING PURIFIER COVERS.

GAS PLANT GENERALLY, PIPES, ROOFING, TANKS, &c.,

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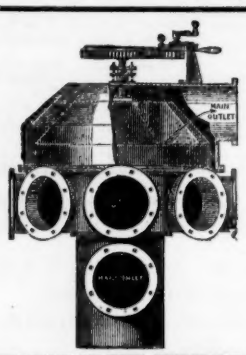
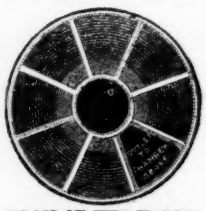
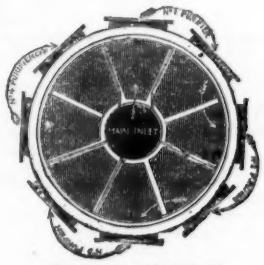
C. & W. WALKERS'
PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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THOMAS ALLAN & SONS,

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WORKS:

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Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.
„ 1½ to 10 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 15s. from Glasgow.

AGENTS FOR LONDON AND THE SOUTH OF ENGLAND:
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THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
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REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

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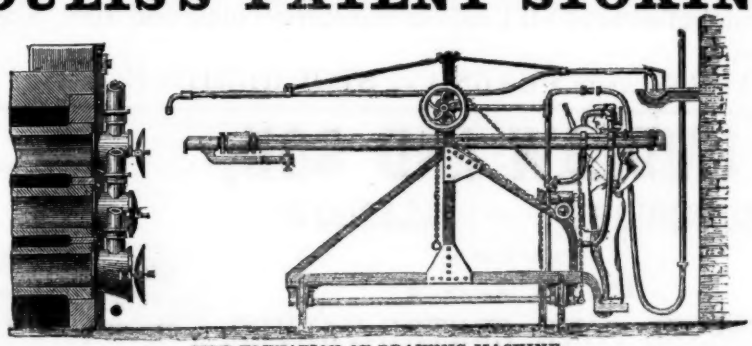
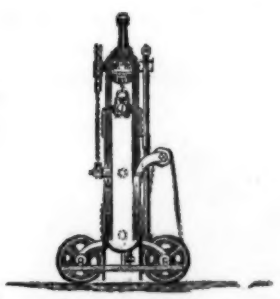


SIDE ELEVATION OF DRAWING MACHINE.



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Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

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"Yours truly, "JAMES PATERSON."

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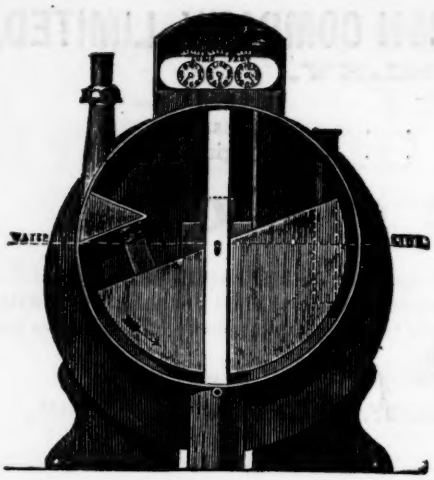

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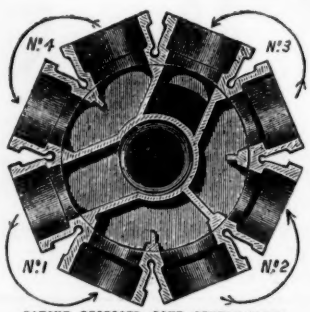

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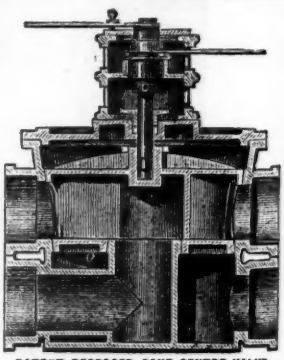

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